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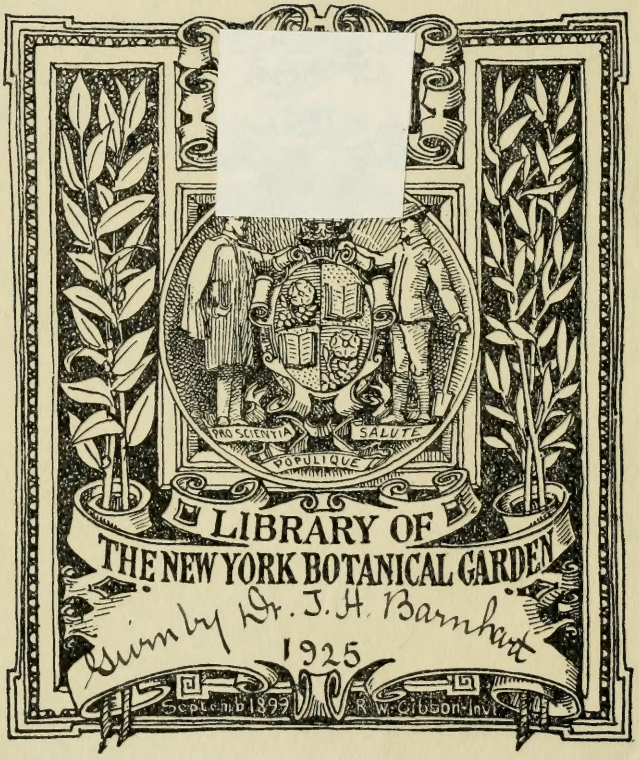
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The Moss Flora of New York City and Vicinity

GROUT

The Moss Flora of New York City and Vicinity

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PREFACE

Although New York City is one of the principal botanical centers of the United States and of the world and has an institution within its borders that has paid special attention to bryophytes, I know of no formal list of its moss flora; I believe none has been published.

On the other hand, materials for such a list are abundant and the large number of people in the city interested in science, either as a profession or diversion, will certainly give a wide field of usefulness to a carefully prepared list arranged in a helpful manner. Such a list will also stimulate investigation into our rapidly vanishing moss flora, and put on scientific record facts of natural history that will soon have vanished beyond the possibility of record or recall.

Probably no other region in the country has had so careful a bryological survey as the late C. F. Austin made of that part of New Jersey lying around Closter. In New Jersey the mosses of the North and those of the South meet, and it seems to one who scans Austin's work with care that he found there almost all the mosses of Eastern North America. Any one who can now duplicate ninety per cent. of his collections in this region may reckon himself a past master in collecting, and one who discovers a moss in this region that Austin overlooked can congratulate himself on his luck.

The area to be included in this list is not to be defined clearly and definitely. All counties of New York and New Jersey lying adjacent to the city are of course included. In the main, localities outside this will be given only for rare or unusual mosses that do not occur within these limits or are very infrequent. An exception will be made in the case of Long Island, as all available information concerning that area will be included.

For fifteen years the author has made a careful study, in the field, of the mosses of eastern Long Island and of Staten Island, in addition to the work already done by others whose names are

given in the body of the text. Most of the data from the Bronx northward have been obtained from the collections of the New York Botanical Garden.

The author hopes that collectors and others who have or acquire additional information concerning the moss flora of New York City and vicinity will communicate it to him in order to have all available facts collated for scientific record and use.

In many ways it would have been preferable to have a work of this kind published and distributed by some one of the local scientific societies, but as insufficient funds were reported available the author has undertaken both the labor and expense of this issue.

The author knows very little about the Sphagna and the list of that genus is frankly a compilation.

Curtis High School, Staten Island, N. Y., Oct. 1916.

INTRODUCTION

As stated in the preface, in and around New York City the moss flora of the North and of the South meet and mingle, and the number of species occurring is large, varied, and interesting. Along the coast we find such species as *Pogonatum brachyphyllum*, *Raphidostegium adnatum*, and *Plagiothecium micans*, which seem to reach their maximum development in the South Atlantic States. In northern Long Island and in the Palisades and mountains of New Jersey we find species like *Hypnum Crista-castrensis*, *Thamnium alleghaniense*, *Sciaromium Lescurii*, and *Andreaea petrophila*, which are characteristic of the mountains and deep cool woods of the North.

A very noticeable fact about the moss flora of this region is the lack of tree-growing forms such as *Orthotrichum* and *Pylaisia* in the immediate vicinity of the city, *Thelia* being almost the only moss found on tree trunks above a few inches from the base. Mrs. Britton reports four species of *Orthotrichum* from New Dorp, but in seven years' careful search I have been unable to discover a single specimen.

As one gets away from the city these mosses begin to appear in normal quantities. For this reason the author is inclined to believe that the gases produced in the city are the cause of this marked absence of arboreal mosses.

No attempt is made to give a full list of localities from which the more common species have been collected. It would add materially to the labor and expense of the work and little to its practical usefulness. In the case of rare or infrequent species not only the locality of collection but the location of authentic specimens is given.

! means that the author has seen the specimen.

!! means that the author has a specimen in his collection and unless otherwise stated the specimen has been collected by him.

Numbers in parenthesis indicate specimens in the collections of the Brooklyn Institute Museum.

H. S. indicates specimens in the herbarium of the Long Island Historical Society, now in charge of the Brooklyn Botanic Garden.

To save space the following abbreviations have been used:

"E. G. B.," for Mrs. E. G. Britton.

"R. S. W.," for R. S. Williams.

"Sanial," for Miss Marie L. Sanial.

"Hulst," for the late Rev. Geo. D. Hulst.

"Latham," for citations from the list of mosses published in the Flora of Southold and Gardiner's Island by S. H. Burnham and Roy A. Latham in Torreya for November, 1914.

"N. Am. Flora," for North American Flora, vol. 15, published by the New York Botanical Gardens.

"Bx!" means that the specimen is in the collections of the New York Botanical Gardens at Bronx Park.

"Flora N. J.," refers to Britton's Preliminary Catalogue of the Flora of New Jersey, Rutgers College, 1881. The mosses were listed almost exclusively from the collections of C. F. Austin.

"Flora L. Id.," refers to The Flora of Long Island by Smith Ely Jelliffe. Lancaster, Pa. 1899.

"Mosses S. Id.," refers to a Preliminary List of the Mosses of Staten Island by Elizabeth G. Britton. Proceedings of the Natural Science Association of Staten Island, Special No. 10, July, 1890.

"Bry. Ct.," refers to the Bryophytes of Connecticut by Evans and Nichols.

"Geol. Survey, N. J.," refers to a list of mosses by E. A. Rau and E. G. Britton, published in the Geological Survey of New Jersey in 1889. This also is founded on Austin's collections but differs in some respects from the earlier list by Britton.

The keys and descriptions are mostly taken from the author's two manuals, "Mosses with a Hand-lens," and "Mosses with Hand-lens and Microscope." The photographs are selected from a large number which are to appear in the third edition of "Mosses with a Hand-lens" now in preparation. The season when the spores mature is indicated in most cases by a word denoting the season.

CLASSIFICATION AND NOMENCLATURE

I have made as few changes in nomenclature as is consistent with clearness and a moderate interpretation of the necessities of the situation. The principle of priority has been allowed great weight, but usage also has its claims and a name long in common use has not been discarded unless convenience and clearness seemed to demand it.

The following is a synopsis of the system of classification followed:

CLASS MUSCI

ORDER I. SPHAGNALES

Family 1. Sphagnaceae.

ORDER II. ANDREAEALES

Family 2. Andreaeaceae.

ORDER III. BRYALES

Suborder I. Nematodonteae

Family 3. Georgiaceae.
Family 4. Polytrichaceae.
Family 5. Buxbaumiaceae.

Suborder II. Arthrodonteae

Group 1. Aplolepideæ—

Family 6. Archidiaceae.
Family 7. Dicranaceae.
Family 8. Leucobryaceae.
Family 9. Fissidentaceae.
Family 10. Grimmiaceae.
Family 11. Tortulaceae.
Family 12. Encalyptaceae.

Group 2. Diplolepideæ

Subgroup Acrocarpae—

Family 13. Orthotrichaceae.
Family 14. Splachnaceae.
Family 15. Funariaceae.
Family 16. Meesiaceae.
Family 17. Timmiaceae.
Family 18. Aulacomniaceae.
Family 19. Bartramiaceae.
Family 20. Bryaceae.

Subgroup Pleurocarpae—

Family 21. Leskeaceae.
Family 22. Hypnaceae.
Family 23. Fabroniaceae.
Family 24. Neckeraceae.
Family 25. Leucodontaceae.
Family 26. Fontinalaceae.

Key to the Families of Mosses

1—Plants whitish or light gray, scarcely appearing green 2
Plants green, yellow-green, or dark green to almost black 3
2—Plants of bogs; leaves with large colorless cells surrounded by narrow green cells; capsules nearly globular, ovoid when dry and empty, without peristome . . . . . *Sphagnaceae*

Plants of moist shady places, growing in dense tufts or cushions; leaves showing but one kind of cells (except in section); capsules elongated, with a peristome ..... *Leucobryaceae*

3—Leaves in two rows, with edges apparently towards the stem 4
Leaves in more than two rows, or if apparently two-ranked the edges of the leaves are not toward the stem 5

4—Leaves apparently split on the inner edge and sheathing each other and the stem, costate; peristome present ..... *Fissidentaceae*
Leaves ecostate, not split at base, but forming a continuous wing-margin along the stem in the sterile plants; peristome lacking. *Schistostegaceae**

5—Acrocarpous 6
Pleurocarpous 21

6—Plants black or blackish green, except at top of growing stems; leaves with very thick cell-walls; growing on trees or rocks 7
Plants green to light yellow-green, sometimes hoary, or, if blackish, growing on soil 9

7—Capsule dehiscing by four valves, as in the Hepaticae, almost exclusively alpine or subalpine ..... *Andreaeaceae*
Capsule dehiscing by an operculum; peristome of 16 jointed teeth 8

8—Peristome single (very rarely lacking), with teeth not united in pairs, but usually perforate or bifid, richly colored and rarely reflexed when dry. Plants often hoary with colorless leaf apices, nearly all growing on rocks ..... *Grimmiaceae*
Peristome double (with one or two exceptions), teeth often united in pairs, rarely perforate, usually reflexed when dry, inner peristome of linear erect segments. Plants very rarely hoary, mostly tree-growing ..... *Orthotrichaceae*

9—Peristome of four large distinct unjointed teeth ..... *Georgiaceae*
Peristome having an inner plaited cone; outer peristome of shorter jointed teeth often present. Odd plants, best recognized by a reference to the illustrations ..... *Buxbaumiaceae*
Peristome lacking, or of more than four teeth 10

10—Peristome of 32 to 64 non-articulate teeth; calyptra densely hairy with long whitish hairs (except *Catharinea*); leaves with numerous vertical lamellae on the upper surface of the costa. Plants large and very often dark colored, growing on soil ..... *Polytrichaceae*
Peristome when present consisting of 16 to 32 plainly articulate teeth, frequently lacking 11

11—Minute stemless plants with cleistocarpous capsules and usually persistent protonema ..... *Ephemereae* of *Funariaceae*
Plants with stems, a few cleistocarpous or gymnostomous but mostly peristomate; protonema usually evanescent 12

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* Not listed.

12—Leaves papillose, at least above (except *Aulacomnium*); capsules strongly plicate or furrowed when dry; peristome double.....13
Plants not possessing all three of these characters.....14
13—Capsules nearly as broad as long, subglobose; inner peristome without cilia or with cilia little developed.....*Bartramiaceae*
Capsules longer than broad, subcylindric; cilia of inner peristome well developed.....*Aulacomniaceae*
14—Capsules cleistocarpous; leaves not papillose.
Archidiaceae and *Bruchia* in *Dicranaceae*
Capsules cleistocarpous; leaves papillose.....*Astomum* in *Tortulaceae*
Capsules gymnostomous; leaf cells small, papillose.
Pottieae and *Weiseae* in *Tortulaceae*
Capsules gymnostomous, leaf cells large, smooth.
Physcomitrium in *Funariaceae*
Capsules peristomate.....15
15—Peristome single.....16
Peristome double.....18
16—Capsules with a large swollen hypophysis, which is usually larger and more conspicuous than the spore-bearing part; leaves not papillose; growing on decaying animal matter.....*Splachnaceae*
Capsules without hypophysis (some with slender necks).....17
17—Leaves papillose.....*Tortulaceae*
Leaves not papillose (except in *Oncophoreae*, one or two species of *Dicranum*, and slightly so in *Ceratodon*). See descriptions and illustrations of these forms.....*Dicranaceae*
18—Inner peristome of cilia only; plants with the habit of *Polytrichum*.
Timmiaceae
Inner peristome of keeled segments, with intermediate cilia often present.....19
19—Segments opposite the teeth; capsules very strongly unsymmetric with mouth one-sided.....*Funariaceae*
Segments alternate with the teeth; capsules less strongly unsymmetric.....20
20—Capsules arcuate and unsymmetric, long-necked; inner peristome of sixteen rather narrow segments as long as the teeth or longer, without intermediate cilia; leaf cells small.....*Meesiaceae*
Capsules often pendent and symmetric, sometimes slightly unsymmetric; inner peristome with well developed cilia (except in a few rare species) leaves often bordered by a margin of narrow elongated cells.....*Bryaceae*
21—Aquatic, long and floating, with leaves straight, or plants shorter with falcate-secund leaves; capsules immersed or emergent, never exserted.....*Fontinalaceae*
Terrestrial (or a few aquatic), seldom slender or floating, with capsules exserted on long setae.....22
22—Leaves papillose (except species of *Myurella*, *Leskea*, and *Thuidium*); leaf cells short, rhomboidal or subcircular.....*Leskeaceae*

Leaves not papillose, (slightly so in species of *Leptodon*, *Cryphea*, and *Bryhnia*).....23

23—Basal joints of peristome teeth marked with very fine transverse lines; segments of inner peristome well developed, keeled; cilia present (inner peristome without cilia and with narrow segments in many species with erect or suberect capsules. The transverse lines, even, are lacking in most of the species of the *Climaceae* and *Entodonteae*); leaf-cells elongated, sometimes rhomboidal but never rounded in the main portion of the leaf (except *Porotrichum*) *Hypnaceae*

Basal joints of teeth without fine transverse lines; capsules symmetric, usually erect on straight setae; cilia of inner peristome lacking; segments usually narrowly linear, occasionally the inner peristome almost lacking. Practically all growing on the bark of living trees..... 24

24—Leaf cells elongated as in the Hypnaceae; peristome teeth often united in pairs. Rare, mostly minute mosses.....*Fabroniaceae*

Leaf cells short and rounded; larger plants, many very common....25

25—Stems and branches flattened; leaves appearing two-ranked. *Neckeraceae*

Stems and branches nearly terete; leaves not appearing two-ranked. *Leucodontaceae*

ORDER I. SPHAGNALES

Family 1. SPHAGNACEAE. The Peat Mosses

The Peat Mosses are so different from the other mosses that many bryologists do not consider them as mosses at all, but would put them in a separate class. Their protonema is much like the prothallium of a fern, and the stalk upon which the capsule is borne is not at all homologous with the seta of the other mosses, as it is an outgrowth from the gametophyte and not the lower portion of the sporophyte, i. e., it is developed from the moss plant instead of from the fertilized egg-cell. The capsules are globose with a well marked operculum but no peristome. The structure of the leaves is also very different from that of the other mosses. The cells of the branch leaves are of two sorts, very large hyaline rhomboidal or elliptical cells with the walls spirally thickened and often perforated by round pores, and the true chlorophyllose cells, which are narrow and elongated and lie between the others. While most forms are grayish green the leaves of some species are pink or deep red and furnish microscopic mounts of very great beauty.

Although the *Sphagnaceae* consist of but one genus, the number of species is very large and the distinctions are very puzzling. They all grow in bogs, swamps, moist mountain summits, etc.

Economically, the peat mosses are of more value than any others. In many portions of Ireland and Scotland peat is almost the only fuel supply of the peasantry. In the United States there is an abundant supply of peat. Dana estimates that there are 15,000,000,000 cubic feet in Massachusetts alone. Peat has been taken out of the excavations for the N. Y. City subways.

SPHAGNUM (Dill.) L.

Key

(Adapted from N. Am. Flora)

1—Cortical cells of the stem and branches reinforced by spiral fibril-bands 2
Cortical cells of the stem and branches without fibril-bands..... 6

2—Chlorophyll cells of the branch leaves entirely included, or exposed about equally on both surfaces 3
Chlorophyll cells of the branch leaves usually triangular in section, with the base exposed on the inner surface of the leaf 4
3—Chlorophyll cells of the branch leaves exposed about equally on both surfaces, with a central lumen ..... *papillosum*
Chlorophyll cells of the branch leaves short-elliptic in section, central and usually entirely included ..... *magellanicum*
4—Chlorophyll cells of the branch leaves usually isosceles-triangular in section ..... *palustre*
Chlorophyll cells of the branch leaves equilateral-triangular in section 5
5—Cortical cells of the branches with their bases plane or nearly so. *imbricatum*
Cortical cells of the branches each communicating by a saccate to funnel-shaped extension with the next cell underneath ..... *portoricense*
6—Cortical cells of the branches uniform, each with a pore at the upper end 7
Cortical cells of the branches of two kinds, the larger retort cells with a neck and a pore in the axils of the leaves; or, if uniform, without pores 8
7—Chlorophyll cells of the branch leaves included ..... *compactum*
Chlorophyll cells of the branch leaves exposed on the outer surface. *strictum*
8—Stem leaves with the membrane of the hyaline cells mostly resorbed on the outer surface, on the inner with membrane-gaps only in the apical cells 9
Stem leaves with the membrane of the hyaline cells usually not greatly resorbed on the outer surface, or if so, resorbed on both surfaces, producing a very lacerate leaf apex 10
9—Plant large; branch leaves ovate-hastate, mostly squarrose ..... *squarrosum*
Plant smaller; branch leaves ovate-lanceolate, usually imbricate ..... *teres*
10—Chlorophyll cells of the branch leaves exposed exclusively or more broadly on the outer surface; or, if with central lumen and approximately equal exposure, the pigment brown 11
Chlorophyll cells of the branch leaves exposed exclusively or more broadly on the inner surface; or, if with central lumen and approximately equal exposure, the pigment red 18
11—Cortical cells of the stem small, thick-walled 12
Cortical cells of the stem larger, thin-walled, in 1-3 layers 13
12—Chlorophyll cells of the branch leaves isosceles-triangular in section, the apex of the triangle reaching the inner surface of the leaf ..... *recurvum*
Chlorophyll cells of the branch leaves equilateral-triangular in section, the apex of the triangle not reaching the inner surface of the leaf ..... *pulchrum*
13—Chlorophyll cells of the branch leaves broadly triangular in section, exposed only on the outer surface ..... *tenellum*

Chlorophyll cells of the branch leaves mostly exposed on both surfaces; if exposed only on the outer surface, narrowly triangular in section.....14

14—Chlorophyll cells of the branch leaves triangular to rhomboidal in section, with broader exposure on the outer surface, the lumen triangular.....*cuspidatum*

Chlorophyll cells of the branch leaves truncately elliptic or rectangular to trapezoidal in section, with equal exposure on both surfaces or slightly broader on the inner surface; or, if with broader exposure on the outer surface, the lumen lenticular and central or nearly so.....15

15—Hyaline cells of the branch leaves without fibrils.....*macrophyllum*

Hyaline cells of the branch leaves fibrillose.....16

16—Chlorophyll cells of the branch leaves exposed equally on both surfaces or more broadly on the outer one.....*subsecundum*

Chlorophyll cells of the branch leaves usually exposed a little more broadly on the inner surface.....17

17—Pores on the outer surface of the branch leaves if present, never more than 2 to each cell.....*Pylaesii*

Pores on the outer surface of the branch or stem leaves always more than two to each cell.....*cyclophyllum*

18—Stem leaves fimbriate-lacerate in the apical part.....19

Stem leaves not notably lacerate in the apical part.....20

19—Lacerate at both sides and apex.....*fimbriatum*

Lacerate only across the broad truncate apex.....*Girgensohnii*

20—Hyaline cells of the branch leaves smaller, their free convexity on the outer surface mostly less than ½ their diameter.....21

Hyaline cells of the branch leaves large in section, their free convexity on the outer surface usually more than half their diameter..23

21—Pigment brown.....*fuscum*

Pigment red.....22

22—Outer surface of the branch leaves with very small round strongly ringed pores in the apical part.....*Warnstorfii*

Outer surface of the branch leaves with much larger elliptic pores.....*capillaceum*

23—Pigment brown, sometimes passing to purplish.....*plumulosum*

Pigment red.....24

24—Margin of the branch leaves entire.....*tenerum*

Margin of the branch leaves denticulate.....*tabulare*

S. erythrocalyx Hampe is reported from New Jersey in N. Am. Flora. It is distinguishable from *S. papillosum* by not having papillae on the chlorophyll cells of the branch leaves.

S. quinquefarium (Lindb.) Warnst. should be found. It is distinguished from *S. capillaceum* by having its leaves mostly as broad as long instead of 1½ or more times as long as broad.

S. capillaceum (Weiss) Schrank. (*S. acutifolium* Ehrh.) Common.

Var. tenellum (Schimp.) A. L. Andrews. "Labrador to New Jersey," N. Am. Flora.

S. compactum DC. (*S. rigidum* Sch.) "Closter, N. J.," Musc. App. 8 (as var. *humile*). The same, No. 7, is from Pine Barrens of N. J.; Beacon Falls, Ct., Nichols, Bx!

S. cuspidatum Ehrh. Frequent.

Var. Torreyi (Sull.) Braith. "Manchester Pond, Ocean Co.," Flora N. J.; New Haven, Bry. Ct.; Greenport, Latham.

S. cyclophyllum Sull. & Lesq. "Stagnant pools and marshes on bog ore beds in Southern N. J.," Musc. App. 25; near Manchester, N. J., Aust., Bx!

S. fimbriatum Wils. "Swamps on the Palisades near Closter, N. J.," Musc. App. 19; swamp, S. Id., Clarke, Bx!

S. fuscum (Sch.) H. Klinggr. New Haven, Bry. Ct.

S. Girgensohnii Russow. In wet woods, Yonkers, E. C. Howe, Bx!; Closter, Austin, Bx!; Hampden, Bry. Ct.

S. imbricatum Hornsch. (*S. Austinii* Sull.). "Swamps near Farrango and Manchester, Ocean Co., N. J.," Musc. App. 2; New Haven, Bry. Ct.

Var. affine (R. & C.) Warnst. Hempstead, L. Id., E. G. B., Bx! (as *S. affine compactum*); Orange, etc., Bry. Ct.

S. macrophyllum Bernh. Southampton, L.Id., Clute, Bx!; pines of N. J., Austin, Bx!; ponds, Ocean, Cumberland, and Gloucester Co's., N. J., Rau, Bx!

S. magellanicum Brid. (*S. medium* Limpr.) New Haven, etc., Bry. Ct.

S. palustre L. (*S. cymbifolium* Ehrh.) Frequent.

S. papillosum Lindb. "Bogs near Batsto," Flora N. J.; N. J. Musc. App. Suppl. 451; East Haven, Bry. Ct.

S. plumulosum Roell. "Labrador to N. J.," N. Am. Flora; New Haven, etc., Bry. Ct. (as *S. subnitens*).

Var. **flavicomans** (Card.) A. L. Andrews. "Southward along the coast to N. J.," N. Am. Flora; New Haven, Bry. Ct.

S. portoricense Hampe. "Ponds and pools of Southern N. J.," Musc. App. 1. "Manchester Pond, Ocean Co.," Flora N. J.

S. pulchrum (Lindb.) Warnst. "Labrador to N. J.," N. Am. Flora.

S. Pylaesii Brid. Border of Pond, Manchester, Ocean Co., N. J., Austin, Bx!

S. recurvum Beauv. Orient, Latham; East Haven, etc., Bry. Ct.

S. squarrosum Crome. "Southward to N. J.," N. Am. Flora.

S. strictum Sull. "Swamps and bogs, Northern N. J.," Musc. App. 20. *Fide* label on this number in the N. Y. Bot. Gardens collection (issued as *S. Girgensohnii*).

S. subsecundum Nees. Common. A synonym of *S. laricinum* Spruce and of *S. neglectum* Ångstr.

S. tabulare Sull. (*S. molle* Sull.) "Southern N. J. to Florida," Musc. App. 9; "Northport, Sanial," Flora L. Id.

S. tenellum Pers. (*S. molluscum* Bruch) "Peat bogs in water an inch or less in depth in Pine Barrens," Flora N. J.

S. tenerum Sull. & Lesq. New Haven, Bry. Ct. [as *S. tenerum* (Aust.) Warnst.]

S. teres (Schimp.) Ångstr. "Low grounds, Closter and Southern N. J.," Musc. App. 21 and Suppl. 452; "Budds Lake," Flora N. J.

S. Warnstorfii Russow. Hampden, etc., Bry. Ct.

ORDER II. ANDREAEALES

Characterized chiefly by the dehiscence of the capsule, which splits into four valves after the manner of the Hepaticae, the valves remaining coherent at the apex; also by the absence of any air cavity between the capsule walls and the spore sac.

Family 2. ANDREAEACEAE.

The only family of the order. Mosses of alpine or subalpine habitat, growing upon granitic or slaty rocks; with the habit and color of *Grimmia*. The appearance is always dark, sometimes black, and the leaves are very brittle and so dense that they need to be soaked in a solution of caustic potash for a few moments, in order to make their structure apparent under the microscope. The presence of chlorophyll in the leaves is not apparent except in very young leaves. Leaf cells small, very thick walled. There is very little difference in the sporophyte in the different species.

ANDREAEA Ehrh.

Leaves without costa ..... *petrophila*
Leaves costate ..... *Rothii*

A. petrophila Ehrh. "Steep dry rocks and boulders near Closter, N. J.," Musc. App. 42. "On boulders near Sparta," Geol. Survey N. J. Summer.

A. Rothii W. & M. (*A. rupestris* of many authors.) "Rocks by the Hudson River, Yonkers," Musc. App. 43 and E. C. Howe, Bx! Summer.

ORDER III. BRYALES

Suborder I. Nematodonteae

Peristome teeth solid, not transversely barred (very faintly so in *Buxbaumia*), derived from several concentric series of cells of the sporogonium.

Family 3. GEORGIACEAE

All of our mosses belonging to this family are distinct in the four-parted peristome, each of the four teeth being composed of a solid mass of cellular tissue. The leaves are ovate or lanceolate, smooth, costate, leaf-cells rounded-hexagonal.

GEORGIA Ehrh.

G. pellucida (L.) Rabenh. (*Tetraphis pellucida* Hedw.) Common in moist woods on humus, less frequently on rotten wood than farther north. Autumn–spring.

Family 4. POLYTRICHACEAE

Plants usually of a large size, the simple or slightly branched stems growing from a creeping underground stem (except *Pogonatum brevicaule* and *P. brachyphyllum*). Stems with a central woody strand, which is the nearest approach to a vascular bundle in the non-vascular cryptogams Leaves usually narrow, with the base sheathing or at least with the basal part of the leaf hyaline with larger cells. The costa bears on its upper surface, except at the hyaline base, *longitudinal strips of tissue (lamellae) one cell thick and attached to the upper surface of the costa by one edge; the upper cell of the lamella is often of a different shape from the others, and seen in cross-section is of great value in determining species.* The upper leaf cells are usually hexagonal. The plants are usually dioicous with the *antheridia borne in conspicuous terminal rosettes.* Capsule on a long smooth seta, large, cylindrical or prismatic, with 4–6 angles. Calyptra cucullate, *covered with a dense felt of hairs, or at least roughened at apex with short spinose projections. Peristome of 32 or 64 teeth, short, without joints, triangular in cross-section. Columella expanded at the top into a circular membrane, the epiphragm, which is attached to the tips of the teeth,* and helps control spore distribution.

Key to the Genera

1—Capsules square or six-angled ..... *Polytrichum*
Capsules cylindric 2
2—Calyptra hairy; leaves not crisped when dry ..... *Pogonatum*
Calyptra not hairy; leaves crisped when dry ..... *Catharinea*

POLYTRICHUM Dill. The Hair-cap Mosses. (Plate II, Fig. 1.)

The leaves are large, not bordered, *with a sheathing membranous base* and very numerous straight lamellae occupying

the greater part of the width of the leaf above the base; upper cell of the lamellae differentiated.*

Capsules prismatic, four-to six-angled, often nearly cubical. Peristome teeth generally sixty-four. Calyptra densely hairy.

KEY

1—Leaf margins serrate, not infolded 2
Leaf margins entire, thin and infolded 3
2—Capsules cubical, beak short ..... *commune*
Capsules much longer than broad, beak long, neck tapering. *Ohioense*
3—Plants of dry situations, small (1 cm. to 2 cm.), leaves with long white awns ..... *piliferum*
Plants larger, leaves without white awns 4
4—Plants of lowlands without felted radicles; capsules 3 mm. to 5 mm. long ..... *juniperinum*
Plants of pine barrens or subalpine regions; stems covered with a dense felt of radicles, capsules 2 mm. to 3 mm. long ..... *strictum*

Our species are readily divided into two groups, as shown in the key. One with serrate plane margins and the other with margins thin and infolded, not serrate except at the extreme apex. These species are all earth-growing.

P. commune L. Very common. A nuisance in old fields where it often crowds out the grass. According to Prof. J. F. Collins most of our material from Long Island and probably elsewhere is var. *perigonale* (Mx.) B. & S. June–July.

P. Ohioense R. & C. Common, more frequent in wooded places. June.

P. juniperinum Willd. Orient, Latham; Hempstead, Hulst (25288)!; High Bridge, Denslow; Huntington, L. Id., J. E. Rogers; Garretstons, S. Id., E. G. B.; Forked River, N. J., Lighthipe; Closter, N. J., Austin. All but the first two localities are represented at the Bronx.

P. piliferum Screb. Dry barren soil, frequent. June–July.

P. strictum Banks. "Pine barrens, common," Flora N. J.; Lakehurst, N. J., in and around bog!!; New Haven, Bry. Ct.

* In making cross-sections of the leaves to determine the nature of the terminal cells of the lamellae, the upper portion of the leaf should be used, as these cells are not characteristic near the base.

POGONATUM Beauv.

The Pogonatums differ from the Hair-caps mainly in the cylindrical capsules, not square or angular in section. The teeth are thirty-two and the capsules are straight or curved. The spores mature in autumn or winter, except in *P. alpinum*, in which they mature about July. Our species are small plants from persistent protonema.

Leaves lanceolate-subulate, serrate; capsules erect ..... *brevicaule*
Leaves lingulate, blunt, entire; capsules inclined when fresh .. *brachyphyllum*

P. brevicaule (Brid.) P. B. [*P. tenue* (Menz.) E. G. B.] Frequent on bare soil.

P. brachyphyllum (Mx.) P. B. Grassy hills, Orient, Latham!! "Sandy loam, Toms River, N. J.," Musc. App. 234.

CATHARINEA Ehrh.

Leaves not sheathing and but slightly embracing the stem, lingulate or ovate-oblong, crisped when dry, with a few (1–7) narrow lamellae; margins bordered, serrate, teeth often in pairs. Calyptra merely roughened with a few vestigial hairs. Capsule cylindric, often somewhat curved; operculum long rostrate; peristome of thirty-two teeth.

The sporophyte of the Catharineae is in good condition from late autumn to early spring.

KEY

1—Leaf cells distinctly papillose ..... *Macmillani*
Leaf cells smooth 2
2—Capsule 4: 1; leaves not at all wavy on the margins when moist, lamellae inconspicuous ..... *crispa*
Capsule 6–8: 1; leaf margins wavy when moist 3
3—Midrib constituting $\frac{1}{8}$–$\frac{1}{10}$ of leaf ..... *undulata*
Midrib constituting $\frac{1}{3}$–$\frac{1}{4}$ of leaf ..... *angustata*

C. crispa James. Frequent in fresh water marshes and along moist banks of streams, especially along the south shore of L. Id.

C. angustata Brid. Very common on rather dry sandy soil, particularly if somewhat shaded. Mr. Geo. S. Bryan, of the Univ. of Wisconsin, has made studies showing that we have another species or that this is frequently monoicous.

C. Macmillani Holzinger. "In dry exposed situations," New Haven and Orange, Bry. Ct.

C. undulata (L.) W. & M. Moist soil in woods. Infrequent except in N. J. Orient, Latham, Prospect Park, Jelliffe, Bx!; Rosedale, L. Id.!!; Banks of the Bronx River, Bronx Park, E. G. B. Bx!!; New Dorp, Princes Bay and Richmond, S. Id., E. G. B. Bx!

Family 5. BUXBAUMIACEAE

Plants very small, almost or quite stemless; growing on earth or rotten wood; leaves few or none; perichaetial leaves present but often disappearing long before the maturity of the capsule. Capsule very large in proportion to the size of the plant, oblique and asymmetric. Calyptra small, conical. Peristome single or double.

A most peculiar and fantastic family, the members of which will be readily recognized by a comparison of the photographs given in Pl. I.

Key

Leaves large and conspicuous..... *Webera*
Leaves absent when sporophyte is mature..... *Buxbaumia*

BUXBAUMIA Haller

B. aphylla L. Closter, Flora N. J.; Five collections from Bronx Park by E. G. B. and R. S. W., Bx!; Yonkers, Mrs. Northrop, Bx!; Lawrence, L. Id., Brainerd, also Jamaica and Cold Spring!! Autumn to spring.

WEBERA Ehrh. (*Diphyscium* Mohr.)

W. sessilis (Schmid.) Lindb. Frequent!! July.

Suborder II. Arthrodonteae

Peristome teeth thin, derived from the cell-walls of a single layer of cells of the sporogonium, transversely barred, sometimes entirely lacking.

GROUP I. APLOLEPIDEAE

Peristome single, composed of two layers of plates made by a deposit on the inner and outer side of the original cell-wall. In the outer layer a single undivided plate forms the entire width of the tooth, but the inner plate is divided by a median line into two parts. The teeth are often partially split along this median line as in *Dicranum*, or entirely cleft to the base as in *Barbula*. *Ceratodon* represents an intermediate condition. With the exception of some species of *Fissidens*, our *Aplolepideae* are acrocarpous.

Family 6. ARCHIDIACEAE

Small terrestrial mosses, mostly perennial; 0.5–1.5 cm. high; branching by innovations below apex. Central strand present. Leaves lanceolate, costate. Capsule apparently sessile, spherical, cleistocarpous, of a single layer of cells, producing about 16 very large polyhedral spores, the largest known in the mosses.

Except for the peculiarities of the capsule wall and spores this family is close to the cleistocarpous Dicranaceae. The capsules often appear lateral, either by successive innovations or by developing on a short branch. The only genus is

ARCHIDIUM Brid.

A. Ohioense Schimp. "Flat rocks, Palisades, Bergen Co., N. J.," Austin, Bx! Autumn to spring.

A. alternifolium (Dicks.) Schimp. "Old fields near N. Y. City," Austin, Bx! (As *Phascum alternifolium.*)

A. alternifolium is paroicous with leaf cells up to 27 by 135μ, while *A. Ohioense* is autoicous, leaf cells 13 by 54μ.

Family 7. DICRANACEAE

Plants varying in size from exceedingly minute to several inches in height, dichotomously branched. Leaves broadly lanceolate to subulate, often sheathing at base, costate, occasionally papillose; leaf cells quadrate or rectangular to linear, chlorophyllose above, more elongated and with little or no

chlorophyll toward the base, often special inflated cells at the basal angles. Calyptra smooth, narrow, cucullate. Capsule on an elongated seta, narrow, oval to cylindrical, frequently cernuous; operculum usually long-beaked; peristome of 16 teeth which are *cleft half-way to the base or further into two lanceolate or subulate divisions*, usually of a reddish color, transversely barred, *with fine vertical striae between* the bars. There are a few cleistocarpous species with capsules rounded and immersed or elongated and exserted.

The leaf character and the peristome when present will usually indicate the family to one who is at all familiar with it, but in some genera it is closely related to the Tortulaceae [e. g., *Ditrichum* and *Trichostomum; Barbula* (*Didymodon*) and *Ceratodon*]. The plants of this family are inhabitants of soil and rocks, rarely growing on trees, frequently on decaying wood.

For convenience our genera may be grouped into eight tribes or subfamilies.

Key to Subfamilies of the Dicranaceae

1—Cleistocarpous; capsules spherical and immersed or pear-shaped and sometimes slightly exserted ..... *Bruchieae*
Capsules operculate and peristomes well developed 2
2—Plants large (with few exceptions); leaves with much enlarged and inflated alar cells ..... *Dicraneae*
Plants smaller; leaves without enlarged and inflated angular cells 3
3—Capsules with a long slender neck, sometimes longer than the urn *Trematodonteae*
Capsules without a long neck 4
4—Rare minute plants of high altitudes or cool cliffs; teeth variable but not cleft to base ..... *Seligerieae*
Peristome teeth cleft to the base into two filiform legs (except *Swartzia*) ..... *Ditricheae, Oncophoreae*
Peristome dicranoid; plants like small *Dicrana* in appearance. *Dicranelleae*
Peristome various; upper leaf-cells minute, often papillose ... *Oncophoreae*

Subfamily Bruchieae

Small (8 mm. or less) yellowish- or brownish-green mosses, growing upon soil in extensive tufts. Protonema often persistent. Leaf cells not papillose and mostly elongated-rectangular; alar cells not enlarged or inflated. Capsules cleistocarpous, subglobose and immersed, or pear-shaped and immersed to fully exserted.

We have only two genera of this subfamily, *Bruchia* and *Pleuridium*. *Bruchia* has capsules with a conspicuously developed neck, so that the capsules are pear-shaped. Because of this long neck the genus is often put in the *Trematodonteae*, but it seems most convenient to follow Limpricht in this matter and certainly no violence is done to natural relationships.

BRUCHIA Schwaegr.

With the characters of the subfamily. Distinguished from *Pleuridium* (except *P. palustre*) by the *pear-shaped capsules* and *mitrate calyptra*; often growing with it, but distinguished easily by a hand-lens by the characters given. Our species catch the eye when growing with *Pleuridium* by reason of the partially exserted capsules.

Paroicous; capsule ovoid; stems up to 1 cm. long; leaves nearly smooth. *flexuosa*

Autoicous; capsule pyriform; stems up to 3 mm. long; leaves subpapillose. *Sullivantii*

B. Sullivantii Aust. Lawrence and Woodhaven, L. Id.!!; West Farms, Sanial, Bx! May. Probably frequent in rather dry fields, often occurring with *Pleuridium subulatum* which matures its spores at least two weeks earlier.

B. flexuosa (Sw.) C. Muell. Mrs. Britton's garden and old fields, New Dorp, S. Id., E. G. B., Bx!; "Wet meadows about Closter and Camden, N. J.," Musc. App. 56.

PLEURIDIUM

Plants annual or perennial, in dense cushions; stems very short, simple or branching; upper leaves longer than the lower; more crowded, erect-spreading (except in *P. Sullivantii*) or secund, not crisped; costa excurrent or percurrent and forming most of the apex; capsules ovoid-globose, apiculate; calyptra cucullate (except in *P. palustre*). Growing in light sandy soil, often among grass. Spores in spring.

Besides *Bruchia* the other genera most likely to be confused with *Pleuridium* are: *Archiaium*, differentiated by having only about sixteen very large (25 mm.) smooth spores and capsule

not apiculate; *Phascum cuspidatum* with a round smooth excurrent costa and upper leaf cells rounded hexagonal and papillose on the back; some other small species of the *Tortulaceae* which also have papillose cell walls, or have ovate or ovoid leaves with costa vanishing or slightly percurrent; *Ephemerum*, in which the plants are stemless, being scarcely more than buds on a persistent protonema.

KEY (adapted from N. Am. Flora)

1—Calyptra mitrate; stomata of the capsule wall median..... *palustre*
Calyptra cucullate; stomata of the capsule wall basal..... 2
2—Leaves erect-appressed, imbricate, ovate or mucronate..... *Sullivantii*
Leaves spreading or secund, lanceolate-subulate..... 3
3—Antheridial buds *usually* axillary to the lower leaves; perichaetial leaves abruptly subulate, the awn long and roughly serrate. *alternifolium*
Antheridia in the perichaetium; perichaetial leaves tapering into the awn..... 4
4—Perichaetial leaves entire at base, awn rough..... *subulatum*
Perichaetial leaves toothed at base, awn nearly smooth..... *Ravenelii*

P. subulatum (L.) Rabenh. Frequent on sandy banks and in old fields. April–June.

P. alternifolium (Kaulf.) Rabenh. New Dorp, S. Id., E. G. B., Bx!; Staten Id.!!; "Old fields, Closter, N. J.," Austin, Bx!; "Glen Cove, L. Id., Sanial," Flora, L. Id. May–June.

P. Ravenelii Aust. "On light sandy soil. New Jersey," Musc. App. Suppl. 457. March–June.

P. Sullivantii Aust. "Light sandy soil in fields. Spores in spring. Orange," Bry. Ct.

P. palustre Br. & Sch. "Old fields, N. J., James," Musc. App. 55; Flushing, L. Id.!! Spring.

SUBFAMILY DITRICHEAE

Plants short or tall; leaves lanceolate-subulate without enlarged alar cells; capsule oval to cylindric, erect or nearly so; peristome of sixteen narrow teeth, which are often cleft to the base into thirty-two filiform cilia.

KEY TO GENERA

1—Leaves glossy, not glaucous 2
Leaves glaucous, with a waxy bloom ..... *Saelania*
2—Upper leaf cells more or less elongated; capsules usually erect and smooth but sometimes inclined and somewhat wrinkled... *Ditrichum*
Upper leaf cells roundish-quadrate, sometimes slightly papillose; capsules inclined and deeply furrowed when dry ..... *Ceratodon*

DITRICHUM Timm.

Plants tufted, slender, growing on soil or rocks; upper leaf-cells narrowly rectangular to quadrate; capsule on a slender straight seta, oval to cylindric, erect or slightly inclined, with an annulus; peristome erect, of sixteen long teeth, cleft into two filiform papillose divisions, which are sometimes more or less united.

1—Monoicous; seta yellow; costa long excurrent ..... *pallidum*
Dioicous; seta orange, red or brownish; costa short excurrent 2
2—Leaves secund, subulate; perichaetium not sheathing ..... *pusillum*
Leaves erect appressed, lanceolate; perichaetium sheathing ..... *lineare*

D. pusillum (Hedw.) Timm. [*D. tortile* (Schrad.) Hampe.] Very common on bare, rather moist soil. Autumn–spring.

D. lineare (Sw.) Lindb. [*D. tortile vaginans* (Sulliv.) Grout.] With the same habitat as the last but less common. Autumn. Immature sporophyte (in early August) is sometimes bright yellow.

D. pallidum (Schreb.) Hampe. Common in rather dry sandy places. June.

SAELANIA Lindb.

Leaves linear-lanceolate, serrate, costate to apex. Differing from *Ditrichum* chiefly in the granular or filamentous "bloom" on the dorsal surface of the leaves, and the minute quadrate to somewhat oblong leaf cells.

S. glaucescens (Hedw.) Broth. "Crevices of rocks, Little Falls, N. J., and Haverstraw, N. Y.," Musc. App. 121.

CERATODON Brid. (Plate II, Fig. 2.)

Plants short (sometimes reaching two or three inches in damp shaded places); in dense cushions matted together with radi-

cles. Leaves small, ovate-lanceolate, acuminate or subulate; cells roundish to quadrate, sometimes slightly papillose dorsally, somewhat elongated at the base. Capsule usually inclined and deeply furrowed when dry. Peristome from a narrow basal membrane, of 16 teeth, bifid nearly to the base.

C. purpureus (L.) Brid., our only species, is one of the commonest of all our mosses. It is found on the edges of paths, roofs of old buildings, sand by the seashore, and in general any barren compact soil is its favorite habitat.

Var. **aristatus** Aust. "Plants taller, often paler; seta yellow; leaves acute or acuminate, costa excurrent; xerophytic." "Sandy barrens of N. J.," Musc. App. 117.

Subfamily Seligerieae

Plants minute, scarcely branched; leaves narrowly lanceolate-subulate, without distinct alar cells; capsule exserted, erect or nearly so. Peristome of 16 short teeth, cleft or perforate or nearly entire (lacking in *S. Doniana*).

SELIGERIA B. & S.

S. Doniana (Smith) C. Muell. "In pockets and hollows of rocks, rare; Sparta & Ogdensburg, New Jersey;" Austin, Bx! Summer.

S. setacea (Wulf.) Lindb. [*S. recurvata* (Hedw.) B. & S.] "On moist shaded rocks at Hohokus and Godwinville, N. J.," Musc. App. 110. Spring-summer.

Subfamily Oncophoreae

Leaves chlorophyllose, opaque, usually papillose, without distinct angular cells, the upper minute, quadrate. Capsule on a long seta, oblong or subcylindric, usually unsymmetric and inclined, usually striate and frequently strumose. The distinguishing characteristic of this subfamily is the small and rounded or quadrate often papillose cells of the upper leaf, and this character indicates a very close relationship to the Tortulaceae, which is also shown in the peristomes of *Saelania* and *Ceratodon*.

KEY TO GENERA

1—Leaves not papillose; capsule inclined and strumose, peristome teeth bifid.....*Oncophorus*
Leaves smooth or slightly papillose; capsule erect, teeth not bifid. *Rhabdoweisia*
Leaves papillose..... 2
2—Capsule erect and symmetric; peristome teeth mostly undivided. *Oreoweisia*
Capsule from nearly erect to unsymmetric and nodding, peristome teeth divided about half way.....*Dichodontium*

RHABDOWEISIA B. & S.

Small mosses growing in dense tufts or cushions, often in damp shaded crevices of rocks and overhanging ledges. Leaves lanceolate to linear, more or less crispate, smooth or mamillose rather than papillose. Capsule erect and symmetric, 8-furrowed when dry; peristome teeth narrowly lanceolate, without median line.

R. denticulata (Brid.) B. & S. "On rocks in ravines, Pascack, N. J., and Rockland Co., N. Y.," Musc. App. 72; Redding, Ct., Bx! Summer.

OREOWEISIA De Not.

Small compactly tufted rock-growing mosses. Leaves ovate-lanceolate to linear-lanceolate, somewhat crisped; lower leaf cells rectangular, smooth; the upper papillose (mamillose) on both sides, square to roundish. Capsule erect, not furrowed; teeth lanceolate, entire or divided.

O. serrulata (Funck.) DeNot. "On perpendicular face of moist rocks, Palisades N. J., and Haverstraw, N. Y.," Musc. App. 70. Sterile in our range.

DICHODONTIUM Schimp.

Plants cespitose or in loose mats. Leaves lingulate to linear-lanceolate, widely spreading when wet, incurved to crispate when dry; lower leaf cells elongate, upper roundish to quadrate, more or less papillose both sides. Capsule cylindric to oblong, erect and symmetric to cernuous and curved; peristome teeth united below, more or less divided.

D. pellucidum (L.) Schimp. "On rocks subject to inundation in deep glens near West Vernon, Sussex Co., N. J.," Musc. App. 76; New Haven, Bry. Ct. Autumn to spring.

ONOCOPHORUS Brid.

Mosses of damp ledges, earth, and decaying wood, mostly moderate in size with leaves long, slender and crispate when dry.

O. Wahlenbergii Brid. Yonkers, E. C. Howe, Bx!

Subfamily Trematodonteae

Plants small, caespitose. Leaves lanceolate-subulate, without distinct angular cells. Capsules with a long slightly inflated neck, which is sometimes longer than the capsule itself. Capsule cernuous; peristome of 16 teeth which are perforate or cleft.

TREMATODON Mx.

Neck about the length of the urn.....*ambiguus*
Neck about twice the length of the urn.....*longicollis*

T. ambiguus (Hedw.) Hornsch. Jamaica!! Summer.

T. longicollis Mx. "Low grounds, Closter, N. J.," Musc. App., 476; Toms River, N. J., Bx!

Subfamily Dicranelleae

Plants small, like miniature *Dicrana*, scarcely branched. Leaves smooth, lanceolate-subulate, without specialized angular cells. Capsule short, erect or inclined, frequently striate; lid beaked; peristome dicranoid, of 16 teeth, cleft to the middle into two filiform divisions.

DICRANELLA Schimp.

Small mosses resembling *Dicranum* in miniature, but without the enlarged angular cells. The general characters of the genus are those of the subfamily to which it belongs. The small size and narrow silky leaves, narrowed gradually or abruptly from a broader base to a channeled subulate apex, render the genus easy of recognition, especially if the dicranoid capsule be pres-

ent. The capsules present variations similar to those of *Dicranum*, but capsules that remain erect and symmetric when dry and empty are rare. Our species are all dioicous.

KEY

1—Seta yellowish, sometimes becoming dark with age..... 2
Seta red..... 3
2—Capsule oblong, tapering at the neck, sulcate, mouth incurved when dry.....*heteromalla*
Capsule oblong, tapering at the neck, scarcely plicate, mouth erect when dry.....*heteromalla orthocarpa*
Capsule gibbous, strumose at neck, smooth when dry.....*cerviculata*
3—Leaves entire..... 4
Leaves serrate or denticulate..... 5
4—Leaves secund; capsule striate when dry; operculum nearly as long as urn; annulus present.....*secunda*
Leaves scarcely secund; capsule smooth when dry; operculum ½ length of urn; annulus lacking.....*varia*
5—Leaves subsquarrose, from a sheathing base.....*Schreberi*
Leaves secund or erect, pellucid by reason of very large thin-walled cells.....*rufescens*

D. heteromalla (L.) Schimp. Frequent on shaded, sandy banks. Autumn-winter.

Var. **orthocarpa** (Hedw.) E. G. B. [Var. *Fitzgeraldi* (R. & C.) Grout.] The most common and abundant moss of the region. Sandy shaded places. Autumn. Hedwig's *Dicranum orthocarpum* was from Lancaster, Pa. Since learning this fact I have changed my opinion as to the name of this form. True *D. heteromalla* with the characteristic curved and wrinkled dry capsule is not very common wherever I have explored in this vicinity.

D. cerviculata (Hedw.) Schimp. "To N. J. and N. Y.," N. Am. Flora. "Peat bog, Hoboken, N. J., Torrey," Musc. Allegh. 167 and Musc. Bor. Am. 49 (Fide E. G. B.). Summer."

D. rufescens (Dicks.) Schimp. "Along shaded banks along roadsides throughout northern N. J. and southern N. Y.," Musc. App. 74; Bronx Park, E. G. B., Bx!!; clay pits at Kreischersville, and near mausoleum in Moravian Cemetery, S. Id., E. G. B., Bx!; Glen Cove, L. Id.!! Summer.

D. varia (Hedw.) Schimp. "On moist banks, rare in Bergen Co., N. J.," Musc. App. 78; Mendham, N. J., Austin, Bx!!;

"Northport, Sanial," Flora L. Id.; S. Id., E. G. B., Bx! Autumn-winter.

D. Schreberi (Schrad.) Schimp. "Wet rocks and banks, Hohokus, N. J.," Musc. App. 77. According to N. Am. Flora Austin's specimens are var. *robusta* Schimp.

Subfamily Dicraneae

Common plants, large and often somewhat branched; some of the rarer species are small. Leaves narrowly lanceolate, often falcate-secund; *cells at the angles enlarged, often inflated, hyaline* or *colored*. Operculum usually long-beaked.

DICRANUM Hedw. (Plate III, Fig. 1.)

Leaves smooth (papillose in *spurium*, *montanum* and occasionally in *pallidum*); lower cells rectangular, *angular conspicuously dilated*. Capsules on a straight erect seta, erect or inclined; teeth red, cleft half-way into two or occasionally three segments, vertically striate below with fine lines.

The *Dicrana* of our region are one of the most common and beautiful elements in woodland scenery. They are, for the most part, bright yellow-green and grow in wide thick tufts or mats. The leaves are frequently more or less secund. They are common on the ground, stones, rotten wood, and sometimes they occur on the base and trunks of trees. Most *Dicrana* mature their spores in autumn, but more observations are needed to give exact dates for each species.

Key

1—Capsule cernuous, more or less arcuate 2
Capsule erect, symmetric 9
2—Upper leaf cells longer than broad, porose 3
Upper leaf cells not porose, nearly as broad as long 5
3—Capsules clustered, leaves strongly transversely undulate, silky. *undulatum*
Capsules solitary 4
4—Leaves transversely undulate when moist, slightly or not at all secund, costa often without lamellae at back; plants dull or pale yellowish green ..... *Bonjeani*
Leaves not at all undulate, secund, with strongly serrate lamellae at back ..... *scoparium*
5—Leaves strongly papillose at back, little or not at all secund .... *spurium*
Leaves not noticeably papillose (sometimes papillose in *pallidum*) 6

6—Capsules clustered ..... *Drummondii*
Capsules solitary 7
7—Costa not reaching apex, smooth at back ..... *Bergeri*
Costa percurrent or excurrent, roughened 8
8—Leaves strongly falcate secund and crispate, upper leaf cells regular. *fuscescens*
Leaves little or not at all secund, upper leaf cells very irregular. *pallidum*
9—Costa ending in the serrulate apex; leaves crisped when dry 10
Costa excurrent; leaves scarcely altered by drying 11
10—Apex of leaf papillose at back; upper leaf-cells rectangular ... *montanum*
Apex of leaf not papillose; upper leaf-cells less regular; plants commonly giving off numerous axillary erect flagella bearing minute ecostate leaves ..... *flagellare*
11—Costa equaling ⅓ width of leaf at the base, or less; leaves gradually narrowed to apex; all upper surface leaf-cells rectangular ..... *fulvum*
Costa ½ width of base of leaf, or more; leaves abruptly narrowed to a long slender point; all upper leaf-cells greatly elongated-linear. *longifolium*

D. Bergeri Bland. Yonkers, E. C. Howe, Bx!; Bedford, Westchester Co., E. G. B. Bx!; "Swamps and wet woods, common in N. J.," Musc. App. 93.

D. Bonjeani DeNot. Swampy woods on New Jersey Palisades opposite Yonkers!!; Englewood, N. J., P. C. Clarke. Late summer or autumn.

D. Drummondii Muell. Orient, Latham!!; Fairfield, Ct., Nichols, Bx!; "Shaded pine woods." T. P. James. Geol. Surv. N. J. Summer.

D. flagellare Hedw. Very common on banks of streams and on hummocks in swampy woods. Summer. More variable than is indicated in most descriptions. An extreme form is

Var. **minutissimum** Grout, on dry peaty banks and stems of bushes forming a sort of close dense "fur." Leaves short, ovate-lanceolate, broad pointed.

D. fulvum Hook. [including *D. viride* (S. & L.) Lindb.]. Flushing, Brainerd (H. S.); Orient, Latham!!; Oyster Bay!!; Yonkers!!; Rocks, Closter, N. J., Austin, Bx!; Bedford and Bronx Park, Bx! Usually growing on rocks in damp shaded places. Late summer and autumn.

D. fuscescens Turn. This species which is abundant in mountainous regions has not yet been reported nearer than the Catskills.

D. longifolium Ehrh. "On shaded rocks and trunks of trees, Northern N. J.," Musc. App. 84. Summer.

D. montanum Hedw. Northport, Glen Cove and Oyster Bay, L. Id.; Haverstraw, Bronx Park and Eastchester; Palisades, Hoboken and Weehauken, N. J. On stones and decaying wood. Summer.

D. pallidum B. & S. On soil in dry sandy places. Cedar woods, Orient, Latham; Tottenville, S. Id., E. G. B.; Lakewood and other Pine Barrens localities, Best, Small and Austin. Spring.

D. scoparium (L.) Hedw. Very common on the ground, stones, etc. in woods, and exceedingly variable. Late summer or autumn. Grades into *D. Bonjeani.*

D. spurium Hedw. Huntington, L. Id., J. E. Rogers, Bx!; "Rocks on Mts., New Jersey," Musc. App. 95; Pine barrens, Lakehurst and Toms River, N. J.!! Spring.

D. undulatum Ehrh. Wading River, L. Id., E. S. Miller, Bx!; "On rocks and the ground near Baumpies Hook, N. J.," Musc. App. 97, and "swamps about Closter," Musc. App. 98 (as *D. robustum*); Montague, N. J., Nash., Bx!

Family 8. LEUCOBRYACEAE

Sporophyte as in Dicranaceae. Plants greenish white. Leaves broadly lanceolate to linear, consisting chiefly of a very broad costa which consists of three or more layers of two different kinds of cells.

LEUCOBRYUM Hampe.

Plants up to 5 cm. or even 10 cm. high; stem leaves 4–11 mm. long, often secund; capsule usually distinctly strumose..... *glaucum*

Plants up to 3 cm. high; leaves 2–4.5 mm. long, never secund, stiff and rigid; capsules scarcely strumose as a rule..... *albidum*

L. glaucum (L.) Schimp. Common, forming dense rounded cushions.

L. albidum (Brid.) Lindb. The only specimen from our range that I can locate is in the herbarium of the N. Y. Bot. Gardens from Herb. J. Cardot, Leg. H. A. Green. The species is distinctly a southern form and H. A. Green collected mostly in the Southern States. I suspect that N. C. and N. J. got confused in Herb. J. Cardot. It is reported from various localities in N. J. in the Geol. Survey but I doubt the authenticity of the material.

Family 9. FISSIDENTACEAE

One of the most natural and easily recognized families. It can be easily recognized even when sterile by the distichous leaves, vertically placed and arranged in one plane, apparently split along the basal portion of the upper edge and clasping the stem and the lower edge of the leaf next above. The leaf-cells are small, rounded or hexagonal. The sporophyte is lateral or terminal, exserted; peristome like that of *Dicranum*, with sixteen forked, highly colored teeth, which are often papillose above.

FISSIDENS Hedw.

Two of our species, *F. Julianus* and *F. Hallianus*, are aquatic or subaquatic; the others are terrestrial, growing with erect stems on damp soil and stones. All have strongly costate leaves. The sheathing base of the leaf is called the vaginant lamina; the terminal lamella above the costa, the vertical lamina; and the dorsal lamella, the inferior lamina. The leaves are often bordered, sometimes with a number of elongated cells, much as in *Mnium*, but, more frequently, with cells of the same shape and size but of a different color.

Key

1—Plants aquatic, filiform, floating 2
Plants terrestrial or submerged, not floating 3
2—Plants large, 2 to 6 inches long, much branched, habit of *Fontinalis*. *Julianus*
Plants small, not exceeding 1½ inches, little branched ..... *Hallianus*

3—Leaves (at least the vaginant lamina) bordered by a narrow band of elongated cells..... 4
Leaves bordered by several rows of paler, often incrassate cells of about the same size and shape as the others..... 5
Leaves not bordered (occasionally the outermost row of cells is a little paler)..... 6
4—Border usually confluent at apex with the percurrent costa; antheridial buds axillary.....*bryoides*
Border at apex narrow or wanting; antheridial buds at base of stem. *incurvus*
5—Leaf-cells obscure, 6 to 9 x 6 to 12μ; dioiccus.....*cristatus*
Leaf-cells distinct, 12 to 15 x 18 to 24μ; monoiccus.....*adiantoides*
6—Costa excurrent.....*taxifolius*
Costa ending in the apex or below..... 7
7—Leaves entire, plants minute, scarcely 2 mm. high in fruit.....*closteri*
Leaves entire, plants in fruit averaging about 1 cm. high....*obtusifolius*
Leaves serrulate..... 8
8—Costa nearly percurrent; leaf-cells 9 to 18 x 12 to 24μ.....*osmundioides*
Costa ending some distance below apex; leaf-cells roundish, 8 to 11μ. *subbasilaris*

F. adiantoides (L.) Hedw. Bronx Park, E. G. B., Bx!; Eastchester, S. H. Burnham; Yonkers, E. C. Howe; Closter, Austin, Bx! "On wet rocks and banks, very common," Musc. App. 106. Winter.

F. bryoides (L.) Hedw. Banks of the Hackensack R., Palisades of N. J. and Haverstraw, N. Y., Austin, Bx! Autumn.

Var. **inconstans** (Schimp.) Ruthe. Palisades, Austin, Bx! (Fide E. G. B.)

F. closteri Aust. "On rocks along rivulets, Palisades near Closter, N. J.," Musc. App. Suppl. 479.

F. cristatus Wils. Dolomite boulder near river, Bronx Park, E. G. B., Bx!; Plainfield, N. J. Weigmann.

F. Hallianus (Sull. & Lesq.) Mitt. "On shaded rocks moistened by spray." Rau, Geol. Sur. of N. J., "Rocky rivulet, Sparta, N. J.," 108b., Musc. App.

F. incurvus Schwaegr. Closter, Austin, Bx!; Brooks, Palisades, Gilman, Bx! Late autumn.

Var. **minutulus** Aust. "On stones in damp shady or springy places, very common," Musc. App. 102; Annadale,

Todt Hill, Richmond Valley, S. Id., E. G. B., Bx!; Bronx Park, E. G. B., Bx!

F. Julianus (Savi.) Schimp. "Rocky streams, N. J.," Musc. App. 108; spring between Demarest and Cresskill, N. J., Austin, Bx!; Kingsbridge!!

F. obtusifolius Wils. On rocks in rivulet, Overlook Park, Princes Bay, S. Id.!!

F. osmundioides (Sw.) Hedw. "On tussock, in springy places in swamps. Common about Closter," Musc. App. 104; Yonkers, E. C. Howe, Bx!; College Point, Brainerd! (H. S.); and Jamaica!! L. Id. Summer.

F. subbasilaris Hedw. "On roots of trees in woods, Closter," Musc. App. 105. Winter.

F. taxifolius (L.) Hedw. Common on shaded soil. Autumn to winter.

Family 10. GRIMMIACEAE

Plants growing upon *rocks*, rarely on soil (at least in our species), blackish-green when dry, almost black below. The young freshly moistened tips of the stems and branches are the only portions that are chlorophyll green. The plants grow in thin mats or more frequently in dense tufts or cushions. The stems of fruiting plants commonly branch by innovations below the apex. The leaves are often hyaline tipped, giving the plants a hoary appearance, but the hyaline tip consists of the whole apex of the leaf; usually lanceolate to ovate-lanceolate, with small thick-walled cells, often in several layers in the upper portion of the leaf. In *Rhacomitrium* the lower leaf-cells are longer, being usually linear, with strongly sinuose walls. The costa is present and is well developed in all the species except *Hedwigia*. The capsules are usually symmetric, ovoid to cylindric, frequently immersed or emergent. The seta is short even in species with exserted capsules, sometimes arcuate, though rarely so in our species. Calyptra mitriform or cucullate, sometimes papillose, smooth or plicate. Peristome single,

often papillose, entirely lacking in *Hedwigia;* teeth entire, cribose or cleft, often resembling those of *Dicranum*, but entirely lacking the vertical striae characteristic of that genus.

The *Orthotrichaceae* are usually included in this family, but I entirely agree with Mr. Dixon that the differences in peristome are fully sufficient to warrant the separation into two families. *Andreaea* is the only genus likely to be misplaced in this family, and when sterile one might easily have difficulty in distinguishing it from the *Grimmiaceae*, but the plants are black even at the top and much more slender than the great majority of the *Grimmiaceae.*

KEY TO THE GENERA

1—Leaves ecostate ..... *Hedwigia*
Leaves costate 2
2—Leaves crispate as in *Ulota* 4
Leaves not crispate 3
3—Basal leaf cells linear, with incrassate sinuose walls; capsules all exserted ..... *Rhacomitrium*
Basal leaf cells but little longer than broad, walls not sinuose ..... *Grimmia*
Basal leaf cells but little longer than broad, upper basal somewhat sinuose; capsules immersed or emergent, not exserted. *Grimmia Pennsylvanica* and forms of *G. apocarpa*
4—Seta straight; upper leaves linear-lanceolate ..... *Ptychomitrium*
Seta arcuate (or sinuose when dry); upper leaves long-linear from a short oblong base ..... *Campylostelium*

HEDWIGIA Ehrh.

Lower part of the plants brown or black, the upper green, with a tinge of gray due to the colorless tips of the leaves; capsules entirely concealed in the longer, more slender perichaetial leaves, the only indication of their presence being a slight enlargement of the ends of some of the branches. The capsules are almost spherical, with a clear-cut lid and no peristome; they mature in spring.

This genus is easily distinguished from all our other *Grimmiaceae* and from the *Orthotrichaceae* by its ecostate leaves; its large size, hyaline leaf apices and ciliate perichaetial leaves prevent any confusion with the ecostate species of *Andreaea.* By recent authors *Hedwigia* is put with the pleurocarpous mosses, where it probably belongs.

H. albicans (Web.) Lindb. (*H. ciliata* Ehrh.) On rocks, frequent. Spring.

CAMPYLOSTELIUM B. & S.

Plants minute, gregarious, on rocks. Leaves crisped when dry, linear-lanceolate; leaf cells above small, round, thick-walled. Calyptra mitrate; seta arcuate; capsule symmetric.

C. saxicola (Web., Mohr.) B. & S. "On sandstone boulders near Closter, N. J.," Musc. App. 109. Winter-spring.

PTYCHOMITRIUM B. & S.

Distinguished from *Grimmia* by the plicate calyptra and crispate leaves.

P. incurvum (Schwaegr.) Sulliv. New Dorp, S. Id., and Bronx Park, E. G. B. (Bx.)!; "Old stone fences, Northern N. J. and Southern N. Y.," Musc. App. 153; Yonkers, Bx!

GRIMMIA Ehrh. (Plate III, Fig. 2.)

Plants dark green to almost black, short-stemmed, growing (in our species) almost exclusively on rocks, in more or less compact cushions. Leaves crowded, more or less appressed and somewhat contorted when dry, but not crispate, spreading to squarrose when moist, lanceolate in general outline, margins usually recurved and entire, except at the apex, which is often hyaline, but is composed of the upper lamina instead of the costa alone, giving the plants a hoary appearance in many species; costa well developed; leaf cells short and rounded above, almost opaque in most species, sometimes papillose; the lower cells elongated, often rectangular and nearly hyaline. Calyptra smooth; capsule ovoid to oblong, symmetric; immersed or exserted; peristome single, of 16 teeth which are entire, perforate, or even cleft in some species.

The genus is usually easily recognizable, but the species are difficult and are often almost impossible to determine in sterile specimens, as some of the critical leaf characters are variable. The position of the margin (recurved or plane) seems to be a fairly constant and useful character. Mature leaves from the

middle and upper portions of stems must be chosen for examination. The hyaline apex is often confined to the mature upper leaves.

KEY

1—Leaves, at least the upper, ending in a whitish hyaline hair point.... 2
Leaves not as above..... 5
2—Capsule longer than the seta, immersed; or if shorter than the seta the upper basal leaf cells are sinuose..... 3
Capsule shorter than the seta, emergent or exserted; no leaf cells sinuose..... 6
3—Upper leaves with long hair points; leaf cells not sinuose; capsule oblong.....*ambigua*
Upper leaves with long hair points; leaf cells somewhat sinuose. *Pennsylvanica*
Upper leaves often with short hair points..... 4
4—Lower leaf cells sinuose, but shorter than in *Rhacomitrium*. *Pennsylvanica*
Lower leaf cells not sinuose (sometimes slightly so in *apocarpa*)..... 5
5—Plants small and slender, in dense cushions, soft dull green; peristome teeth strongly cribrose; central strand present in stem..*conferta*
Plants larger, loosely tufted; central strand lacking; peristome less cribrose.....*apocarpa*
6—Leaf margins erect, of one layer of cells; seta curved.....*Olneyi*
Leaf margins slightly recurved on one side at least, of one layer of cells; seta straight.....*leucophea*

G. apocarpa (L.) Hedw. "Common on rocks in moist ravines," Musc. App. 134. Frequent on S. Id. but much of the plant is possibly var. *rivularis*. Bronx R. near bridge, E. G. B., Bx! No specimens known from L. Id.

Var. **gracilis** (Schleich.) W. & M. "Shaded rocks, Palisades and Greenwood Mts.," Musc. App. 135; Bloodroot Valley, S. Id., E. G. B., Bx! Autumn-winter.

G. ambigua Sull. "Rocks on High Tom, Haverstraw, N. Y.," Musc. App. 142.

G. conferta Funck. "On rocks on the ground, Passaic Falls, N. J.," Musc. App. 138. Varieties on limestone rocks near Sparta and in Southern N. J., Musc. App. 139 & 140. "On trap rocks near Haverstraw, N. Y.," Musc. App. 141.

G. leucophea Grev. "Exposed rocks, Palisades," Musc. App. 146. Spring.

G. Olneyi Sulliv. "On exposed rocks, Palisades and Northern N. J. and Southern N. Y.," Musc. App. 144. April.

G. Pennsylvanica Schwaegr. "On dry rocks, common," Musc. App. 143; Northport and Gowanus, L. Id.; Van Cortland Park, N. Y. Bot. Gardens, Tuckahoe, Eastchester; Closter, N. J. Autumn–winter.

RHACOMITRIUM Brid.

Plants with much the habit and appearance of *Grimmia, but usually larger*, and in many species *bearing numerous short lateral branchlets*, giving the plants a *peculiar modose appearance.* The leaves are hyaline pointed in most of our species and the lower leaf cells, at least, *are much elongated with thickened sinuose-nodose cell walls*, which character is the principal distinction from *Grimmia:* the leaf margins are recurved in almost all cases.

1—Some or all of the leaves with a hyaline point at apex..... 2
Leaves lacking hyaline point.....*aciculare*
2—Plants with many short lateral branchlets; upper leaf cells at least 3 times as long as broad, sinuose.....*microcarpum*
Short lateral branchlets lacking; upper leaf cells round-quadrate. *sudeticum*

R. aciculare (L.) Brid. "Rocky beds of streams, Palisades, N. J.," Musc. App. 147; Bath, L. Id., Brainerd (H. S.)! Spring.

R. microcarpum (Schrad.) Brid. "Exposed rocks in the Ramapo Mts. of N. Y. & N. J., rare," Musc. App. 149; Closter, Austin, Bx!; Musc. App. 148 issued as *R. sudeticum* from Suffern, N. Y. & northern N. J. is in my set this species. Yonkers, E. C. Howe, Bx!

R. sudeticum (Funck) B. & S. Probably the only data for this species from our range is from Musc. App. 148 as noted above. Some of this number may possibly be this species.

Family 11. TORTULACEAE

With few exceptions short-stemmed mosses, radiculose at base only, often caespitose, growing mainly on soil. Leaves of various shapes, margin usually entire and of only one layer

of cells, costa strong; basal cells usually thin-walled, hyaline and rectangular; upper cells usually thick-walled, quadrate to subcircular, papillose. Seta straight; calyptra cucullate, smooth, capsule erect and symmetric or nearly so; cleistocarpous, gymnostomous, or, usually, peristomate; peristome when present of 16 straight or spirally twisted teeth which are often divided into two filiform papillose divisions, appearing as if there were 32 teeth.

Key to the Genera

1—Leaves widest at or near base, usually tapering to an acute apex.. 4
Leaves increasing in width from the base upwards, usually broad in outline and rounded at the apex except for the excurrent costa (some forms of *Barbula unguiculata* may be sought here)..... 2
2—Peristome lacking (in our species).....12
Peristome present (very short in some species of *Desmatodon*)..... 3
3—Costa strongly excurrent into a hair point; peristome of 32 filiform teeth from a high basal membrane, twisted to the left.....*Tortula*
Costa not excurrent (except in *D. plinthobius*); peristome teeth 16. *Desmatodon*
4—Plants minute; cleistocarpous..... 5
Plants larger; capsule opening by a lid; peristome lacking or present.. 6
5—Areolation dense and strongly papillose above; upper leaf margin strongly involute.....*Astomum*
Leaves more loosely areolate, margin slightly revolute above..*Phascum*
6—Peristome lacking; leaf margins plane or revolute.....*Gymnostomum*
Peristome lacking; leaf margins involute (forms of).....*Weisia virdula*
Peristome present..... 7
7—Leaves with margin more or less revolute (scarcely so in *Barbula convoluta*), curled or occasionally crisped when dry; basal cells rarely hyaline, usually yellowish or reddish..... 8
Leaves with margin plane or involute; basal cells mostly hyaline; costa often excurrent; leaves usually crisped when dry..... 9
8—Peristome teeth 16, more or less divided or perforate along the median line, erect or twisted to the right.....*Didymodon*
Peristome teeth 32, filiform, strongly twisted to the left.....*Barbula*
9—Leaf margin strongly involute.....*Weisia viridula*
Leaf margin plane or leaves concave.....10
10—Basal leaf cells hyaline, elongated-rectangular and extending obliquely up the margin; peristome of 32 long twisted teeth. *Tortella*
Basal cells not as above, or, if so, not extending up the margin; peristome of 16 untwisted teeth (in our species).....11
11—Leaves as in *Tortella*, except that the hyaline cells do not extend up the margin.....*Trichostomum cylindricum*

Leaves with a lighter margin as in some species of *Fissidens*.
Desmatodon Porteri

12—Costa excurrent ..... *Pottia*
Costa ending below apex ..... *Hyophila*

PHASCUM (L.) Schreb.

Is a genus clearly intermediate between the Ephemeraceae and the Tortulaceae, but more closely allied to the latter. Plants very small, growing close together, with short erect stem clearly marked, thus differentiating the genus from most of the Ephemeraceae. Leaves ovate to lanceolate and entire (in our species), papillose above. Capsule immersed or somewhat emergent, subglobose.

P. cuspidatum Schreb. Closter, Austin; Highbridge, N. Y.; New Dorp, S. Id., E. G. B., all at Bx! Also Musc. App. 53 from N. J. Early spring.

Subfamily Weisieae

Small persistent plants with stems usually short and rarely radiculose, not glossy. Leaves lanceolate or linear-lanceolate, equally spreading, usually keeled, seldom obtuse, twisted when dry, basal leaf cells hyaline and rectangular, upper almost always isodiametric and papillose; costa usually strong. Capsules mostly exserted (except in *Astomum*), small, symmetric, oblong or ovoid, seldom cylindric, with stomata normally phaneropore, capsules cleistocarpous (in *Astomum*), gymnostomous, or peristomate. Peristome when present of 16 short, more or less imperfect, entire or somewhat divided, erect teeth.

ASTOMUM Hampe

Small gregarious mosses growing on soil. Leaves crisped when dry, narrow, keeled; upper leaf-cells small, round, quadrate, papillose on both sides. Capsules immersed (in our species) subglobose, apiculate, oftentimes with a distinctly formed lid which can be removed but which does not fall of itself: calyptra cucullate.

Easily distinguished from *Bruchia* by its deeply immersed capsules, and from both *Bruchia* and *Pleuridium* by the leaves

crisped when dry and strongly papillose on both sides; very strongly resembling sterile *Weisia viridula*.

A. Sullivantii (Schimp.) Hampe. Common in old fields, gardens and meadows. *A. crispum* and *A. nitidulum* have been frequently reported but my observations incline me to the belief that we have but one species. For a full discussion of the matter see Mosses with Hand-lens and Microscope, pp. 137–139. The leaves are much like those of the next. Autumn to spring.

WEISIA Hedw.

Small mosses growing in tufts or mats on soil, especially rather dry sandy soil in our species, freely branching; upper leaves usually much larger than the lower, erect-spreading, strongly crispate when dry, elongated-lanceolate with the costa usually excurrent into a short point; basal cells rectangular and hyaline, the upper small roundish and thickly papillose with small papillae; capsule well exserted on a seta of moderate length, usually erect and symmetric, ovoid, plicate when dry and empty; peristome rudimentary, teeth short, sometimes perforate or somewhat divided, rarely almost lacking.

W. viridula (L.) Hedw. Very common in rather dry soil and occasionally growing in more moist situations. It is exceedingly variable in its peristome and its size. It may usually be distinguished from *Astomum* when sterile by its larger size and longer leaves.

Var. **gymnostomoides** (Brid.) Muell. "Rocky ground, Palisades of N. J.," Musc. App. 63.

GYMNOSTOMUM Hedw.

Plants dioicous, densely caespitose, ferruginous below, growing mostly in limestone regions. Leaves small, gradually increasing in size upwards, tufted at apex, scarcely crisped when dry, but somewhat twisted and appressed, linear-lanceolate to narrowly linear, costa and lamina papillose on both sides with rather low papillae; lower cells rectangular, upper roundish quadrate; capsule long-exserted, erect, symmetric, ovoid to oblong-ovoid, smooth and glossy when first ripe; peristome

lacking, lid falling easily or remaining attached to the columella; calyptra cucullate, extending half way down the capsule.

Upper leaf cells minute, opaque; margin of leaves plane; operculum falling at maturity ..... *rupestre*
Upper leaf cells clear and pellucid, margin of leaf revolute on one side at least; operculum remaining attached to the columella ..... *curvirostre*

All our species of *Gymnostomum* grow on wet ledges and cliffs in dense mats or cushions from 1–10 cm. thick. Some one of these species can be found on wet cliffs in almost any region fortunate enough to have the cliffs.

G. curvirostre (Ehrh.) Hedw. This species is put in the genus *Hymenostylium* by many recent authors. "Wet rocks, Godwinville, N. J.," Musc. App. 61; Little Falls, N. J., Austin, Bx!; Verplancks Point, N. Y., N. L. B., Bx!; "Bath, C. H. Hall," Flora of L. Id. Autumn.

G. rupestre Schleich. "Damp shaded rocks, rather common," Musc. App., 60; Hohokus and Little Falls, N. J., Austin, Bx!

Subfamily Barbuleae

Plants usually with a reddish brown tinge, leaves gradually narrowed to the acute apex (except *Barbula unguiculata* and *Tortella caespitosa*). Costa usually vanishing into apex or slightly excurrent. Peristome as in the Tortuleae except that the basal membrane is always narrow.

BARBULA Hedw.

Leaves mostly lanceolate from a broader base, somewhat contorted when dry but scarcely crispate, *margins revolute;* upper cells small, roundish-quadrate, papillose, quadrate to rectangular and transparent to colored at base. Capsule oblong to cylindric, not altering when dry; operculum conic and beaked; peristome of 32 filiform twisted teeth.

1—Perichaetial leaves long- convolute-sheathing ..... *convoluta*
Perichaetial leaves not conspicuously sheathing or different 2
2—Leaves usually obtuse and mucronate by the excurrent costa. *unguiculata*
Leaves acute, costa not excurrent ..... *fallax* and *reflexa*

B. convoluta Hedw. On ashes, Lakehurst, N. J.!!; Demarest, Hoboken and Palisades, N. J., Austin, Bx! According to R. S. Williams, Musc. App. 122 (*Desmatodon arenaceus*) is this species, at least in part.

B. fallax Hedw. On stones and soil, Hoboken, N. J., Austin, Bx! My specimen of Musc. App. 125 is *B. unguiculata*, at least in part. I have not examined the Hoboken specimen.

B. reflexa Brid. (*B. recurvifolia* Schimp.) is a variety or subspecies of *B. fallax*, distinguished by its reddish brown color, strongly squarrose-recurved lower leaves, broader, shorter and abruptly pointed. "On rocks, Hoboken, N. J.," Musc. App. Suppl. 496.

B. unguiculata (Huds.) Hedw. On damp earth and stones, frequent. Autumn to spring.

DIDYMODON Hedw.

Leaves mostly lanceolate from a broader base, somewhat contorted when dry but scarcely crispate, *margins revolute;* upper cells small, roundish quadrate, nearly smooth to strongly papillose, sometimes elongated and transparent at base. Capsule oblong to cylindric, not altering when dry; operculum conic and beaked; *peristome of 16 teeth, undivided, perforate, or divided nearly to the base as in Ceratodon, short, not twisted.*

D. rubellus (Hoffm.) B. & S. "On rocks along streams, northern N. J.," Musc. App. 143. Summer to autumn.

TRICHOSTOMUM Hedw.

The genus differs from *Didymodon* in having the leaf-margins plane or incurved, and in the elongated-rectangular or linear basal cells. Distinguished from *Tortella* by the short untwisted peristome and the fact that the basal cells do not extend up the margin.

T. cylindricum (Bruch) C. Müll. (*Didymodon cylindricus* Wahl.) "Moist rocks and banks, Northern N. J., also Southern and Central N. Y.," Musc. App. 114; Orange, Bry. Ct. Rarely fruiting.

TORTELLA (C. Müll.) Limpr.

Usually growing in dense rather deep tufts, densely leaved. Much like *Barbula*, but the leaves are *cirrhate-crispate* (except *T. fragilis*) when dry, spreading to recurved, longer, *elongated-oblong to linear-lanceolate with margins plane or involute;* costa strong, ending in the apex or excurrent; upper leaf cells papillose with large papillae; *basal cells sharply differentiated from the upper, hyaline, elongated and extending up the margins to a noticeable extent*, rectangular, linear near the margins; peristome well developed and twisted.

All our plants of this genus have previously been included in *Barbula* by American authors.

Key

1—Leaves long lance-linear, obtusely acute, abruptly mucronate by the excurrent costa; monoicous ..... *caespitosa*
Leaves long-acuminate; dioicous 2
2—Leaves twisted crispate when dry, of one layer of cells throughout. *tortuosa*
Leaves erect, rigid, much less contorted when dry, of two layers of cells above ..... *fragilis*

T. caespitosa (Schwaegr.) Limpr. "About the roots of trees, common," Musc. App. 127; Closter, Pompton, Palisades, N. J., Austin, Bx!; Richmond, S. Id., E. G. B., Southampton, L. Id., both at Bx!; Sandy beach, Orient, L. Id., Latham. Spring.

T. fragilis (Drumm.) Limpr. "Dry limestone rocks at the New Jersey Zinc Mines," Musc. App. 129.

T. tortuosa (L.) Limpr. "On rocks, common," Musc. App. 128. Usually sterile.

Subfamily Pottieae

Leaves broad in outline and narrowed toward the base. Costa excurrent in most species. Calyptra cucullate; capsules gymnostomous (in our species).

POTTIA Ehrh.

Plants short, rarely branched, scattered or in tufts. Leaves soft, broad in outline, enlarging upwards, ovate to oblong, usually papillose (but not so in our most common species),

costa reaching apex or beyond; areolation rather lax for the family. Capsule erect and exserted on a straight seta, ovoid to cylindric; peristome lacking in our species.

P. truncatula (L.) Lindb. (*P. truncata* Fuern.) Hempstead, L. Id., New Dorp, S. Id., Bronx Park, E. G. B. All at Bx.; Hackensack, N. J., Austin, Bx! On soil in fields. Late autumn to spring.

HYOPHILA Brid.

Leaves subspatulate, more or less denticulate, slightly papillose, with costa ending below apex. Capsule narrowly cylindrical-oblong; peristome lacking.

H. riparia (Aust.) Fleisch. (*Pottia riparia* Aust.) "Moist rocks along streams, Palisades and northern N. J. & southern N. Y.," Musc. App. 112; Hohokus, Pascack, and Little Falls, N. J., Austin. Rarely fruiting.

Subfamily Tortuleae

Leaves broad, oblong to spatulate or lingulate. Peristome of thirty-two long filiform spirally twisted teeth or of sixteen shorter scarcely twisted teeth. Costa nearly always excurrent.

Encalypta species are likely to be sought here, especially if sterile, but the papillae in *Encalypta* are very large and verrucose and the costa not excurrent or very shortly so. In *E. streptocarpa*, our most common species, the leaf margins are incurved above and the apex almost cucullate.

DESMATODON Brid.

This genus as a whole is scarcely distinct from *Tortula*, except that the basal membrane is very narrow or lacking, and the peristome is short and scarcely twisted, sometimes so short as to be scarcely visible with a hand-lens.

D. arenaceus S. & L. "On the ground near Closter and Southern N. J.," Musc. App. 122. According to R. S. Williams some at least of this number is *Barbula convoluta*.

D. Porteri James. Easton, Pa., Musc. App. 123. This is likely to be found nearer.

TORTULA Hedw.

Plants robust, with large oblong or subspatulate leaves which are rounded at apex and usually have the costa long-excurrent, not crispate when dry, but somewhat twisted and contorted, mostly entire; upper leaf cells opaque and papillose (except *T. mucronifolia*), basal rectangular and hyaline or colored. Peristome teeth thirty-two, from a high basal membrane (except *T. muralis*), papillose and twisted to the left.

T. papillosa grows on tree trunks, the rest of our species on soil and stones. Distinguished from our species of *Desmatodon* by the high basal membrane and thirty-two spirally twisted teeth.

KEY

1—Growing on trunks of trees; leaves very concave, with costa very short-excurrent and bearing propagula; never fruiting..... *papillosa*
Growing on soil and stones..... 2
2—Leaves with a short hair point, bordered with 2–4 rows of yellowish linear cells in two layers..... *marginata*
Leaves with a long hair point, not bordered..... 3
3—Hair point rough; basal membrane nearly equaling the teeth in length..... *montana*
Hair point smooth or nearly so; basal membrane narrow..... *muralis*

T. marginata (B. & S.) Spruce. Palisades, N. J., Austin, Bx!

T. montana (Nees) Lindb. "Sunny rocks, usually calcareous, in mountainous or hilly regions," East Haven and Orange, Bry. Ct. "Foot of Palisades and Zinc Mines, Sussex Co., N. J.," Musc. App. 132. (As *T. ruralis* var. *rupestris*.)

T. muralis (L.) Hedw. "On old walls, Palisades and central N. J.," Musc. App. 130. Very common on mortared walls beside trolley line, Dongan Hills to New Dorp, S. Id.!!; Bronx Park, E. G. B., Bx!

T. papillosa (Muell.) Wils. Greenwood, L. Id., Brainerd (24284); "On trunks of shade trees, central N. J., also on limestone rocks about the Zinc Mines," Musc. App. 133; "Trunks of buttonwood trees, Batsto, James," Flora N. J.; Hamden, Ct., Nichols, Bx!; Orange, Bry. Ct.; red cedars, St. John's Guild gate, S. Id., W. T. Davis, Bx!

Austin's habitat on rocks is very unusual.

Family 12. ENCALYPTACEAE

The mosses of this family grow on soil or stones and are erect and usually caespitose. The leaves in our species are broad and lingulate or spatulate; lower leaf cells thin-walled and hyaline; upper cells small, dense and opaque, bearing strong verrucose papillae. The extinguisher-like calyptra is the most characteristic thing about the family, and because of it these mosses are often called Extinguisher Mosses. The members of this family belong in the single genus.

ENCALYPTA Schreb.

which is so much like some species of the *Tortulaceae* that Brotherus in "*Die Planzenfamilien*" makes it only a subfamily of the *Tortulaceae*. In many respects our species strongly resemble the species of *Tortula*. The leaves are large and tongue-shaped and are twisted when dry, but the costa is little or not at all excurrent. In fruit, the peristome and the characteristic calyptra are enough to render identification easy, in sterile plants the beginner might make a mistake. The plants are much too large to be confused with *Desmatodon*, and the percurrent or barely excurrent costa distinguishes from all of our species of *Tortula* except *T. papillosa*, which has simple papillae, or *T. mucronifolia*, which has no papillae at all.

In *Encalypta* we have a curious combination of peristome characters; the striking similarity of the calyptra and leaves in the various species makes it certain that no mistake is made in putting them all in one genus; yet within the limits of this one genus we have almost all degrees of completeness of the peristome, from none at all to one highly developed and double. Some of the peristomes show a strong likeness to the nematodont type, while in *E. procera* there is an almost typical arthrodont double peristome.

Leaves apiculate to acuminate ..... *ciliata*
Leaves obtuse ..... *streptocarpa*

E. ciliata (Hedw.) Hoffm. "Wet rocks near Haverstraw, N. Y.," Musc. App. 174.

E. streptocarpa Hedw. "On limestone rocks, Sussex Co., N. J.," Musc. App. 175; Swartswood, N. J., Wiegmann.

GROUP 2. DIPLOLEPIDEAE

Peristome double, the plates of the outer side of the teeth (outer peristome) in two rows, separated by a zigzag median line; inner side of teeth of a single row of plates.

Inner peristome thin and membranous, made up of the inner walls of the same cells whose outer walls formed the inside plates of the teeth. The teeth of the inner peristome are known as segments, and are usually 16, alternating with the teeth, somewhat keeled, usually arising from a basal membrane $\frac{1}{6}$ to $\frac{1}{2}$ the height of the teeth, and in the highest development separated by 1–3 hair-like cilia of varying lengths. The segments may be opposite the teeth and without basal membrane or cilia as in *Funaria*. The segments themselves may be reduced to a mere filament, as in *Orthotrichum*. The entire inner peristome may be lacking in degenerate types, as in some species of the *Bartramiaceae*, or even the entire peristome may be lacking, as in *Physcomitrium*.

Subgroup 1. Acrocarpeae

Sporophyte terminal from erect, or nearly erect stems, sometimes becoming lateral by innovations. In these respects the plants of this subgroup are like most of those of the preceding families.

Family 13. ORTHOTRICHACEAE

This family somewhat resembles the *Grimmiaceae*, but nearly always *grows on trees*. The plants are small, rarely reaching an inch in height and usually much shorter, blackish or brownish green below; nearly always growing in tufts or cushions. The leaves are oblong- or linear-lanceolate and usually very hygroscopic; cells of the upper part hexagonal to rounded-hexagonal, thick-walled and often papillose; lower cells oblong to rectangular, rarely papillose, thinner walled in most cases, and often hyaline; costa single, strong. The calyptra is nearly always hairy and the capsules often immersed, *with very distinct longitudinal wrinkles when dry and empty*. The peristome usually

consists of 16 *rather short teeth, which are nearly always reflexed when dry and are often united in pairs; the inner peristome is usually represented by 16 slender hairlike processes*, often called cilia, but really homologous with the segments of the type of peristome found in *Mnium* and *Hypnum*. In some cases the peristome may be simple or even wanting, as in *Amphidium*. This family is often united with the Grimmiaceae, from which it is distinguished by the italicized characters. Members of these two families may become so dry and brittle as to crumble to dust in the fingers and yet retain their vitality unimpaired, springing into renewed growth with the next rain.

KEY TO THE GENERA

1—Calyptra smooth, cucullate; peristome none or very short and single; rock-growing except *Drummondia* 2
Calyptra mitrate, nearly always hairy; peristome well developed, almost always double; growing almost exclusively on trees 3
2—Tree-growing; capsule long-exserted; peristome single, short and truncate. Common ..... *Drummondia*
Rock-growing; capsule barely exserted; peristome lacking ... *Amphidium*
3—Capsule exserted; leaves crisped, except *U. Americana* ..... *Ulota*
Capsule immersed or emergent; leaves not crisped when dry. *Orthotrichum*

AMPHIDIUM (Nees) Schimp. (*Amphoridium* and *Zygodon* of authors)

Slender-stemmed dichotomously branching plants growing on rocks, usually in dense tufts from 3–8 cm. in depth, rather densely radiculose. Leaves linear to lance-linear, twisted and contorted to crispate; costa strong, reaching nearly to apex; upper leaf cells small, thick-walled, rounded or angular, said to be papillose but the papillae are very low and inconspicuous; basal cells becoming gradually elongated-rectangular and thinner walled, also lighter colored or even hyaline. Calyptra cucullate, without hairs. Capsules erect, emergent or exserted, with a distinct neck, becoming urn-shaped and 8-striate when dry; peristome none.

Both species mature their spores in summer.

Autoicous; leaf margins plane; seta 1.5 mm. long or less ..... *lapponicum*
Dioicous; leaf margins recurved below; seta about 3 mm. long .... *Mougeotii*

A. lapponicum (Hedw.) Schimp. "Crevices of rocks, northern N. J.," Musc. App. 154.

A. Mougeotii (B. & S.) Schimp. "Wet rocks with the preceding," Musc. App. 155; Hamden, Bry. Ct.

DRUMMONDIA Hook.

Drummondia usually grows on the bark of trees, but is easily distinguished from its tree-growing allies by three characters. Its stems are long and closely applied to the bark of the tree, sending out short horizontal branchlets so thickly that the stems below become apparent only when the plant is removed. The capsule is on a long seta, the calyptra is cucullate, and the peristome is so small as to be scarcely apparent.

D. clavellata Hook. On trunks and branches of trees, particularly *Juniperus Virginiana*, and on old stone fences, very common," Musc. App., 152; Cold Spring, Jamaica and Ridgewood, Lloyds Neck and Greenwood, L. Id.; Bedford, N. Y. Summer.

ULOTA Mohr.

The species of Ulota have the characteristic brownish-green or blackish-green color of the *Orthotrichaceae*. They are distinguished from all save *Orthotrichum* by the hairy calyptra. Both *Orthotrichum* and *Ulota* grow on the bark of trees or more rarely on rocks, in cushions of varying size and thickness. *Ulota* growing on trees usually grows in more rounded tufts, with the leaves more crisped when dry than is usual with *Orthotrichum* growing in similar situations. The median basal leaf cells are often nearly linear, upper cells slightly papillose to smooth. The books all say that the hairs on the calyptra of *Ulota* are flexuous, and those on *Orthotrichum* straight, but this distinction appears to be rather too fine for the amateur to profit by it. The capsules in both genera are erect and symmetric and quite regularly striate when dry, with eight or sixteen ridges and as many alternating furrows. These ridges consist of cells larger, darker, and thicker-walled than the alternating tissue. The peristome may be single or double. The seta in *Orthotrichum* is so short that the capsule is nearly always partially

immersed; in *Ulota* the seta is long enough to exsert the capsule entirely beyond the perichaetial leaves.

The remarks in the discussion of *Orthotrichum* on the condition of capsules suitable for study apply equally to *Ulota*.

KEY

1—Growing on rocks; leaves not crisped ..... *Americana*
Growing on trees; leaves crisped when dry 2
2—Capsule abruptly narrowed to the small mouth, smooth except near the mouth ..... *Ludwigii*
Capsules wide mouthed, distinctly plicate ..... *crispa* and *var. crispula*

U. Americana (Beauv.) Lindb. Common; reported as occasionally occurring on trees. Summer.

U. Ludwigii Brid. On trees, Closter, N. J., Austin, Bx! Autumn.

U. crispa Brid. Frequent in outlying districts. Spring–summer.

Var. **crispula** (Bruch.) Hamm. "On trees, particularly *Betula lutea*, rather scarce," Musc. App. 159; Closter, N. J., Austin, Bx!; Jamaica L. Id., Brainerd (H. S.)

ORTHOTRICHUM Hedw. (Plate IV.)

Plants comparatively short-stemmed, in close rounded cushions, sometimes looser, on trees everywhere, and more rarely on rocks. Leaves hygroscopic, imbricated when dry and not greatly curled or twisted, which character separates the genus from *Ulota* except *U. Americana*. Upper leaf cells usually papillose, thick-walled, the lower thinner-walled and quadrate to rectangular. Calyptra sparsely hairy or naked. Base of seta enclosed in a minute cup-like sheath, the ochrea. Capsule immersed or emergent, rarely exserted; usually with 8 regular folds, or plicae, when dry, but sometimes smooth or with 16 plicae. Peristome usually double, with 16 broadly lanceolate teeth, which are usually united in pairs. Inner peristome of 8–16 narrow segments, often called cilia. The paired (*bigemminate*) teeth and degenerate inner peristome illustrate well the degeneracy of peristomes on erect capsules.

The Orthotrichums are most frequent on trees about houses, and in orchards and village streets, although they are not lack-

ing in other situations where the trees stand somewhat apart. They can be found abundantly on almost any fruit or shade tree in the country. In the larger cities, for some reason, they do not seem to thrive. They may frequently be found growing with *Ulota*, from which the immersed or emergent capsule and non-crisped leaves distinguish them at once. The calyptras are less densely hairy than those of *Ulota*. Two species have a calyptra without hairs. The leaves have revolute margins, except in *O. obtusifolium*. *Drummondia* has the general appearance of an *Orthotrichum* with an exserted capsule, but the calyptra is cucullate and without hairs and the capsule is not wrinkled when dry.

Sterile specimens are often indeterminable. The stomata furnish an excellent and definite microscopic character and are easily observed by separating a capsule into two or more divisions with the dissecting needles and mounting outside up; the stomata are nearer the middle of the capsule than in many mosses and are therefore, easier of observation. The condition of the material is of the utmost importance. The capsule must be thoroughly soaked in hot water for a long time to be fully expanded, and the dry capsule must be thoroughly dry to be characteristic. The capsules of all species shrink progressively with increasing age, and many varieties had their origin in this fact. The plants should be moistened to determine whether the capsules are immersed, emergent, or exserted. The peristomes are often quite brittle and are apt to be broken, especially the segments. For identifying species, perfect calyptras are of the greatest value and importance.

KEY

1—Rock-inhabiting species; peristome single, teeth 16, erect or erect-spreading on dry capsules, stomata immersed 2
Tree-inhabiting species; peristome double, teeth usually united into 8 pairs, recurved or reflexed when dry 4
2—Capsule fully exserted, 16-striate ..... *anomalum*
Capsule immersed or emergent, 8-striate 3
3—Capsule ovate-cylindric, urn half emergent when dry ..... *Porteri*
Capsule much shorter, ovate-globose, leaves nearly reaching mouth of urn when dry ..... *Lescurii*
4—Stomata superficial (*i. e.*, with both guard-cells on the surface) 5
Stomata immersed 6

5—Capsule smooth, or very slightly plicate around the mouth when dry and empty ..... *striatum*
Capsule plicate the whole length when dry ..... *sordidum*
6—Capsules strongly contracted under the mouth when dry, and so strongly plicate that the red-brown folds are almost in contact on the outside when dry and empty ..... *strangulatum*
Capsules very slightly or not at all contracted, much less strongly plicate, pale, whitish or yellowish 7
7—Leaves entire, blunt at extreme apex ..... *Ohioense*
Leaves (some at least) dentate with projecting cells, often apiculate.. 8
8—Leaves mostly acute at apex, not rounded; usually some with an apiculus of a single projecting cell; capsules plainly 8-plicate when dry ..... *Schimperi*
Leaves obtuse, rounded and some sharply denticulate at apex with several projecting cells; capsule smooth or faintly 8-plicate when dry ..... *pusillum* .

O. anomalum Hedw. Rocks, Palisades, Flora N. J.; Branford, Bry. Ct. May–June.

O. Lescurii Austin. "On dry shaded rocks, northern N. J. and southern N. Y.," Musc. App. 163; Pascack and Palisades, N. J., Austin, Bx!

O. Ohioense S. & L. College Point, Jamaica, and Sag Harbor, L. Id.; New Dorp, S. Id.; Bedford, N. Y.; "On trees, N. J. and N. Y.," Musc. App. 170 (As *O. Citrinum*); Trumbull, Ct. April.

O. Porteri Aust. "On dry limestone rocks, Sussex Co., N. J. and Orange Co., N. Y.," Musc. App. 162 (as *O. Peckii*); on rocks near Jerome Ave., Mott Haven, Sanial, Bx!

O. pusillum Mitt. "On shade trees, central N. J.," Musc. App. 171; Little Falls, N. J., Sanial, Bx!; Rockland Lake, N. Y., Jelliffe, Bx!; New Dorp, S. Id., E. G. B., Bx! May.

O. sordidum S. & L. "On trees, N. Y. and N. J., very common," Musc. App. 168; On red cedars, New Dorp and on willows back of mausoleum, Todt Hill, S. Id., E. G. B., Bx!; Cold Spring, L. Id.!! Spring–summer.

O. Schimperi Hamm. "On shade trees in towns and villages of central N. J.," Musc. App. 165; New Dorp, S. Id., Van Cortland Park, Bronx Park, E. G. B., Bx! Spring.

O. strangulatum Sulliv. Frequent. May–June.

O. striatum (L.) Hedw. "On red cedars, Palisades, rare," Musc. App. 172.

Family 14. SPLACHNACEAE

The mosses of this family are rather short-stemmed with leaves distant and flaccid, with a loose areolation, not papillose. The calyptra is cucullate, or entire and conical. Capsules erect and symmetric, with a very pronounced and characteristic hypophysis, which in some species is so exaggerated as to become a striking natural curiosity The peristome is single in all our species. The teeth are often united in pairs or more rarely in fours, much as in *Orthotrichum*, and are sometimes reflexed as in that genus. The hypophysis is well supplied with stomata and is made up of loose tissue well adapted for the assimilation of carbon dioxide.

The mosses of this family nearly all grow upon decaying animal tissue or upon animal excreta, more rarely upon decaying vegetable matter, and this, taken in connection with the peculiar hypophysis, makes fertile plants unmistakable. The flaccid leaves, with their loose areolation, distinguish sterile forms from most mosses except, perhaps, the *Funariaceae* and *Meeseaceae*.

TETRAPLODON B. & S.

T. australis S. & L. "On excrement of herbivorous animals in the cedar swamps of southern N. J., frequent," Musc. App. 177.

Splachnum ampullaceum L. is reported from Quaker Bridge, Burlington Co., in Geol. Survey N. J.

Family 15. FUNARIACEAE

Plants annual, sometimes biennial, growing on soil that is bare or sparsely covered with other vegetation, rather short with large wide soft leaves much like those of the last family, usually having a well developed costa extending, in most cases, well toward the apex. The leaf cells are parenchymatous,

large and thin-walled, elongated hexagonal to oblong above, usually rectangular at base. Capsules subglobose, ovoid, or pyriform, erect and symmetric, or strongly unsymmetric and sometimes cernuous, often with a distinct neck. Peristome lacking or single or double. The teeth when present are 16, and the segments are opposite the teeth instead of alternate with them as in *Mnium* or *Hypnum*. There is no basal membrane or intermediate cilia. Calyptra often inflated, usually with a long beak, cucullate or often split in two or more places. I have followed Brotherus in including the *Ephemereae*.

Key

Stem erect, mostly simple; seta in most cases more or less elongated; capsule always exserted, usually opening by a distinct lid. . *Funarieae*

Plants very small, almost stemless, from a persistent protonema; seta rudimentary or lacking; capsules immersed, mostly cleistocarpous. *Ephemereae*

Subfamily Funarieae

Key to Genera

1—Capsules erect and symmetric; peristome lacking 2

Capsules strongly unsymmetric; peristome present, usually double. *Funaria*

2—Capsules exserted on a long seta ..... *Physcomitrium turbinatum*

Capsules immersed 3

3—Capsule splitting exactly in the middle, with no specially modified cells along the line of dehiscence; angles of cell walls of capsule thickened (collenchymatous) ..... *Aphanorrhegma*

Capsule dehiscing by a regular lid having 1–3 rows of denser cells around its mouth; cell walls of capsule collenchymatous. *Physcomitrium immersum*

APHANORRHEGMA Sulliv.

A small genus of only two known species. It seems to differ from *Physcomitrium* chiefly in the much less differentiation of the tissues along the line of dehiscence of the capsule.

A. serratum Sull. "On damp ground, common," Musc. App. 178; Closter, Austin; three localities at New Dorp, S. Id., and two in the Bronx, E. G. B.; all at Bx! Sept.–Dec.

PHYSCOMITRIUM Brid. (Plate VI, Fig. 1.)

Mostly small light green plants sparingly branching. Leaves oblong, obovate, spatulate or broadly oblanceolate. Calyptra

small, mitrate, usually covering less than ½ the capsule. Capsule on a long seta, in a few cases immersed, erect, symmetric, with a distinct lid but no peristome; annulus present, often persistent.

P. turbinatum (Mx.) Brid. On bare soil and in fields. Very common and freely fruiting. Early spring with the blue violets.

P. immersum Sull. Banks of the Delaware, Camden, N. J., Austin and James. See Musc. App. 179; see also Bull. Torr. Bot. Club, 21: 190. This must occur nearer to N. Y. City. It is the only species maturing its spores in the fall and is likely to be mistaken for *Aphanorrhegma*. The latter splits exactly along the middle line and has cell walls of capsule collenchymatous.

FUNARIA Schreb. (Plate V, Fig. 2.)

Funaria strongly resembles *Physcomitrium* in everything except sporophyte characters. Calyptra inflated at base, finally oblique with base cucullate. Capsule more or less gibbous, narrowed to a rather short neck, wrinkled to strongly sulcate when dry; mouth more or less one-sided. Peristome double in our species; teeth 16, often twisted spirally and united at their tips; segments 16; opposite the teeth, without basal membrane or intermediate cilia.

Leaves long acuminate, costa excurrent in some of the leaves of each plant ..... *flavicans*
Leaves short acuminate, costa percurrent, sometimes very shortly excurrent ..... *hygrometrica*

F. hygrometrica (L.) Sibth. Common on soil recently disturbed or burnt over, also on basement walls of houses and mortared walls. Spring.

F. flavicans Mx. Flatbush, Brainerd (24561); Yard, 360 Lenox Rd. Brooklyn!!; Orient, L. Id., Latham; Closter, N. J., Austin; Lakehurst, N. J.!!; Bedford Park, R. S. Williams!!

Subfamily Ephemereae

Exceedingly minute plants, about 1 mm. to 2 mm. high, stemless, usually with persistent protonema, usually scarcely visible except as a green film over the soil, composed merely of

a bud-like cluster of leaves enclosing the subglobose cleistocarpous capsule. Leaves minute, leaf cells rhomboid-hexagonal, longer below, shorter above, smooth, or slightly papillose in one or two species of *Ephemerum;* costa present, except in *Nanomitrium* and some species of *Ephemerum.*

Growing on bare, moist earth.

KEY TO THE GENERA

1—Green protonema persistent, leaves lanceolate..... 2
Green protonema not persistent, leaves ovate.....*Acaulon*
2—Capsule wall colorless, of a single layer of cells, without stomata; rudimentary operculum well differentiated and easily separating when mature capsules are pressed.....*Nanomitrium*
Capsule wall colored, of more than one layer of cells, with stomata; operculum not differentiated, capsules dehiscing irregularly. *Ephemerum*

NANOMITRIUM Lindb. (*Micromitrium* Aust.)

Resembling *Ephemerum,* but differing in the characters mentioned in the key and in the usually smaller capsule almost without apiculus and the minute persistent calyptra. The leaves are ecostate and the columella lacking in mature capsules. Salmon's figures show a single row of transversely elongated cells extending around the capsule between lid and urn. These cells are almost linear in shape and break upon pressure, thus causing the lid to separate and open the capsule. The plants of this genus are said to be rather rare, but this probably is because of their small size, which renders them so inconspicuous that they are rarely collected. Apparently the spores mature in late autumn to early spring.

N. Austinii (Sulliv.) Lindb. "On wet broken ground in woods, Closter, N. J.," Musc. App. 45; Rockland Co., N. Y., Austin, Bx!; Hamden, Ct., Nichols, Bx!

N. synoicum (James) Lindb., distinguished from *Austinii* by the entire leaves, has been found at Camden and Swedeboro, N. J., and probably will be found nearer.

EPHEMERUM Hampe

Minute plants developed on a persistent, much-branched, green protonema. Leaves lanceolate to narrowly ovate-lanceolate, costate except in *E. serratum* and *E. megalosporum;* capsules

immersed, cleistocarpous, subglobose, minutely apiculate, colored, possessing spore-sac and a columella which may be partially absorbed at maturity; stomata present; capsules dehiscing irregularly; calyptra small, campanulate, torn at base but sometimes on one side only. Spores maturing in late autumn to early spring.

The very abundant protonema in this and in *Nanomitrium* is a striking feature, as it often almost obscures the plant when mounted under the microscope.

KEY

1—Leaves ecostate 2
Leaves costate 3
2—Leaves strongly serrate; stomata at base of capsule only ..... *serratum*
Leaves very slightly serrulate above; stomata on the upper part of capsule ..... *megalosporum*
3—Calyptra papillose, leaves papillose both sides ..... *papillosum*
Calyptra smooth 4
4—Costa excurrent into a long spinulose awn-like acumination which constitutes the greater portion of the leaf above the capsule. *spinulosum*
Leaves gradually long-acuminate, scarcely serrate at apex ..... *sessile*
Leaves gradually long-acuminate, strongly serrate at apex. *crassinervium*

E. crassinervium (Schwaegr.) CM. "On damp ground, very common," Musc. App. 48 (in part); Closter and Palisades, N. J., Austin, Bx!; Batsto, N. J., James.

E. megalosporum (Aust.) Salmon. Closter, N. J., Austin, Bx!; Orange, Bry. Ct.

E. papillosum Aust. "On thin soil and rocks, Palisades, N. J.," Musc. App. 50.

E. serratum (Schreb.) Hampe. "Fields and gardens near Closter, N. J.," Musc. App. 47b; ten collections from S. Id., mostly near New Dorp, E. G. B., Bx!

E. sessile (B. & S.) CM. "Closter, N. J., Austin," L. & J. Manual: 39.

E. spinulosum Schimp. "Inundated or wet places, very common," Musc. App. 49; New Dorp, S. Id., and Bronx Park, E. G. B., Bx!

ACAULON C. Muell.

The species of this genus are distinguished by their broadly ovate loosely areolate smooth costate leaves; leaves and leaf cells broader and proportionately shorter than in *Ephemerum*, but growing in the same situations. Early spring.

Perichaetial and upper leaves carinate, margins reflexed..... *triquetrum*
Perichaetial and upper leaves concave, margins plane..... *rufescens*

A. rufescens Jaeg. Fields Brooklyn, Austin (24270)!; "old fields, N. J.," Musc. App. 51; Closter, Austin, Bx!; Tottenville, S. Id., E. G. B., Bx!

A. triquetrum (Spruce) CM. "Sandy fields, Toms River, N. J.," Musc. App. 52.

Family 16. MEESEACEAE

Plants of wet boggy places, frequently growing with *Sphagna*. Leaves spreading to squarrose-recurved, of a rather firm structure, ovate-lanceolate to elongated-lanceolate. Costa long and stout, ending a little below the apex. Leaf cells smooth (papillose in *Paludella*), rather small above, large and more elongated below. Seta usually *very long and slender*. Calyptra cucullate. Capsules curved-pyriform, with a conspicuous neck, smooth or somewhat striate when dry; operculum small, short conical; mouth small; annulus of one or two rows of cells; peristome double, the inner usually much longer than the outer and consisting of 16 narrow segments alternating with the teeth, cilia sometimes present.

All of our mosses of this family seem to be rather rare. The bog habitat, the long seta and the curved pear-shaped capsules with a small mouth, clearly establish the identity of any member.

MEESEA Hedw.

Stems more or less elongated and radiculose. Upper leaf cells rectangular to hexagono-rectangular. Neck of capsules long; segments of inner peristome often united by lateral hair-like appendages bearing nodules; teeth short, usually obtuse. The spores of our species ripen from late June to August.

M. triquetra (L.) Ångstr. "Wet meadows, Closter, N. J.," Musc. App. 217.

Family 17. TIMMIACEAE

Tall robust mosses resembling *Polytrichum* in appearance when sterile; growing in deep loose tufts on soil and rocks. Leaves lanceolate from an appressed sheathing base, serrate above, strongly costate to apex, but costa much narrower than in *Polytrichum*, and entirely without lamellae; leaf cells small, round-hexagonal, smooth or rarely lightly papillose. Calyptra cucullate; seta long; capsules often somewhat wrinkled when dry, but scarcely plicate or sulcate, when fresh resembling those of *Mnium* and *Bryum*. Peristome like that of *Mnium*, except that the inner is composed of cilia only, which are grouped together in fours.

TIMMIA Hedw. (Our only genus)

T. cucullata Mx. (as *T. megapolitana* Hedw.). Yonkers, E. C. Howe (Bx.)!; "Banks of ravines, Northern N. J.," Musc. App. 227; Pascack, N. J., Austin, Bx!

Family 18. AULACOMNIACEAE

Intermediate between the Bartramiaceae and the Mniae, with some characters of the Meeseaceae. From the Mniae it differs in the much smaller papillose leaf cells and in having the capsule regularly striate or sulcate when dry. From the Bartramiaceae it differs in the larger broader leaves and the more elongated and less unsymmetrical capsules with well-developed cilia in the inner peristome. It differs from the Meeseaceae, except *Paludella*, in the perfectly developed peristome, less conspicuous neck of the capsule, and the papillose leaf cells.

AULACOMNIUM Schwaegr.

Usually caespitose, growing on soil in moist woods or in bogs; green above; often brown or brownish green below; stems often densely matted with radicles. Leaves large, strongly costate nearly or quite to the apex; leaf cells small, rounded, strongly thickened at the angles (collenchymatous), in most species strongly papillose on both sides, each cell bearing a single

large papilla in the middle of each surface. Branches frequently terminating in flagelliform pseudopodia bearing propagula at their tips; calyptra cucullate; capsule oblong to subcylindric, cernuous and usually somewhat unsymmetric, with a short neck (so short as to be easily overlooked in some species), regularly plicate or sulcate when dry. Annulus early deciduous. Peristome perfect, as in Mnium.

Leaves broad, apex rounded or acutish, strongly serrate; monoicous. *heterostichum*
Leaves lanceolate, acute, serrate or crenulate at apex; dioicous. . . . *palustre*

A. palustre Schwaegr. Common everywhere in swamps!! June.

A. heterostichum (Hedw.) B. & S. Frequent, preferring soil at base of trees in moist woods. May–June.

Family 19. BARTRAMIACEAE (Plate V, Fig. 1.)

Plants of medium or large size, usually growing in large deep tufts or cushions on soil or rocks in moist shaded places; often developing whorled innovations below the places where archegonia or antheridia have been produced. Leaves strongly costate to near the apex or beyond, acute, papillose (except *Bartramia Oederi*), usually serrate. Leaf cells roundish-quadrate to rectangular. Calyptra small, cucullate; seta rather shorter than in the related families; capsule nearly globular, usually without neck, usually cernuous and somewhat unsymmetric, regularly plicate or sulcate when dry; peristome double in all our species; cilia frequently rudimentary or lacking; segments split along the median line and the halves widely divergent, sometimes appearing as if bordering the teeth.

Key to Genera

Leaves elongated-lanceolate to linear-lanceolate; inner peristome with cilia rudimentary or lacking. . . . . *Bartramia*
Leaves much shorter, ovate-lanceolate; cilia present. . . . . *Philonotis*

PHILONOTIS Brid

Our species of this genus are water-loving mosses, growing on wet banks and rocks where water trickles, or on the margins

of pools or streams. The stems are densely radiculose below. This genus differs from *Bartramia* chiefly in the characters mentioned in the key and in the much more slender habit, with a strong tendency to the whorled innovations mentioned above. The plants are nearly always dioicous and the perigonial leaves are made the basis of specific distinctions in this genus to a very unusual extent.

P. fontana (L.) Brid. "Huntington and Northport, Sanial," Mosses of L. Id.; "Banks of rivulets in springy places, common," Musc. App. 223; Suffern, N. Y., Musc. App. 224. May–June.

P. Muhlenbergii (Schwaegr.) Brid. "Wet banks, Sussex Co., Rau; Newfoundland, Mrs. Britton," Geol. Surv. N. J.

BARTRAMIA Hedw.

Bartramia grows in moist niches in cliffs and on moist shady banks, looking much like tufts of green wool. The capsules are globular and somewhat unsymmetric when moist, but dry with regular folds and alternate ridges. When very dry the body of the capsule becomes so shrunken as to be smaller than the mouth of the capsule itself. The leaves are long and slender and somewhat curled when dry, and strongly papillose. *B. Oederi* is somewhat of an exception as regards leaf characters, and by recent writers is put in the genus *Plagiopus*.

Leaves lanceolate, not papillose ..... *Oederi*
Leaves nearly linear, very long and narrow, papillose ..... *pomiformis*

B. pomiformis (L.) Hedw. Shaded banks; occasional. Cold Spring, Oyster Bay and Roslyn, L. Id.; Princess Bay, S. Id.; Bronx Park, Eastchester, High Bridge, Riverdale; "very common," Musc. App. 221; also Palisades and Toms River, N. J. April–May. (Plate VII, Fig. 1.)

B. Oederi (Gunn.) Sw. Yonkers, Southworth, Bx!; "Banks of ravines Northern N. J.," Musc. App. 222. May–June.

Family 20. BRYACEAE

For the most part large conspicuous mosses growing in close tufts, or loosely aggregated, or scattered; some forms spreading by stolons have the habit of sterile pleurocarpous mosses. Leaves usually large, smaller below and increasing in size upward to the upper, which often form a distinct comal tuft, all supported by a strong costa which extends nearly to the apex, or may be somewhat excurrent, and in many species by a thickened border of narrower elongated cells. Leaf cells large and comparatively thin-walled, short and broad in the *Mnieae*, longer and narrower in the *Bryeae*. A few species are small with small leaves, but with the characteristic sporophyte of the family. Calyptra cucullate. Capsules proportionately large, pendent or drooping, often light-colored, not striate or plicate when dry, usually symmetric. Peristome characteristically perfect, cilia sometimes rudimentary or lacking.

Key to Subfamilies

Plants larger; leaf cells not more than twice as long as broad; cilia not appendiculate (*Rhodobryum* will be sought here) ..... *Mnieae*

Plants usually smaller; leaf cells more than twice as long as broad; cilia often appendiculate, occasionally wanting ..... *Bryeae*

Subfamily 1. Bryeae

1—Plants large, with the habit of a large *Mnium*, from creeping, rhizome-like stolons; upper leaves in rosettes 12–20 mm. across; capsules clustered ..... *Rhodobryum*

Plants smaller, without rhizomelike stolons 2

2—Leaves ovate to ovate-lanceolate; leaf cells rhombic to rhombic-hexagonal, never linear except at margins 4

Leaves linear-lanceolate or narrower (the lower are often broader); leaf cells narrowly rhombic to linear 3

3—Leaves linear from a broader base, hairlike; cilia appendiculate. *Leptobryum*

Upper leaves linear-lanceolate; cilia not appendiculate, sometimes wanting ..... *Pohlia*

4—Leaves not bordered; dioicous; annulus lacking; stomata immersed; leaf cells long and lax; growing in water or very wet places. *Mniobryum*

Leaves often bordered; inflorescence various; stomata superficial; leaf cells usually shorter ..... *Bryum*

With the exception of *Rhodobryum*, *Leptobryum*, *Plagiobryum*, *Bryum argenteum* and possibly *Mniobryum*, it is extremely difficult to determine species of this subfamily unless perfect fruiting specimens can be obtained. It will be a discouraging task to any one except a specialist in the group, and one not worth while under any ordinary circumstances.

LEPTOBRYUM Schimp.

L. pyriforme (L.) Wils. Moist cliffs and stones, fields and mortar in basement walls of houses and walls; also greenhouses; frequent. June–July.

POHLIA Hedw.

Plants tufted, usually growing on moist soil and stones. Lower leaves shorter, ovate-lanceolate as a rule, the upper longer, the comal usually linear-lanceolate; costa ending just below apex, percurrent or rarely excurrent; leaf cells narrowly rhomboidal to linear; capsule pear-shaped or clavate, usually with a proportionately long tapering neck; cilia of inner peristome not appendiculate.

This subgenus is sometimes treated as a subgenus of *Bryum*, from which it differs in little except the narrower areolation and narrower comal leaves.

1—Capsules very short and small; stems not red ..... *Lescuriana*
Capsules larger and longer; stems often red when old 2
2—Bearing gemmae in the axils of the leaves of the sterile stems; dioicous; infrequent or rare ..... *proligera*
Not producing gemmae; never wholly dioicous, sometimes polygamous. 3
3—Infrequent, growing principally in the mountains; leaf cells very long and narrow, linear-vermicular, 11–16: 1; lower leaves large, broadly ovate ..... *cruda*
Common everywhere; leaf cells broader; lower leaves smaller than in *cruda*, ovate ..... *nutans*

P. cruda (L.) Lindb. Alpine, N. J., Austin; Yonkers, Southworth; Kreischerville, S. Id., E. G. B., all at Bx!

P. Lescuriana (Sulliv.) Grout. "On banks along roadsides, Palisades, northern N. J. and southern N. Y.," Musc. App. 190; frequent on Staten Island!! Spring.

P. nutans (Schreb.) Lindb. Common in swampy places. Early summer.

P. proligera (Lindb.) Correns. Roadside bank, N. Y. Bot. Gardens, E. G. B., Bx!; banks of brooks, Richmond and Rossville, S. Id!!; Beacon Falls, Hamden, and New Haven, Bry. Ct.

MNIOBRYUM (Schimper ex parte) Limpr.

All species dioicous; antheridia in the axils of the perigonial leaves. Leaves serrate at apex, not margined, but marginal cells somewhat narrower than the median; leaf cells as a whole broader than in *Bryum* but longer and narrower than in *Mnium*, thin-walled. Capsules pendent, small and short, pear-shaped; *stomata immersed;* annulus lacking; peristome perfect. Plants of wet places, such as springs, ditches, banks of streams and ponds.

M. albicans (Wahlenb.) Limpr. (*Bryum Wahlenbergii* Schwaegr.) "On moist rocks and banks, common but rare in fruit," Musc. App. 189; Bronx Park and S. Id., E. G. B., Bx!; Richmond, S. Id.!!; Orient, Latham.

BRYUM Dill. (Plate VI, Fig. 2.)

Plants densely tufted, interwoven with radicles, usually with branches arising below the "flowers." Leaves ovate to lanceolate, thin and very little hygroscopic, rarely obtuse; cells smooth, rather large, rhombic to hexagonal, quadrate to rectangular at base, the marginal often very narrow and forming a more or less distinct, sometimes thickened border; costa usually excurrent. Capsule on a long seta, usually more or less pendulous, pyriform but varying from subglobose to elongated-clavate, usually symmetrical; operculum conical, usually apiculate but never rostrate; annulus present; peristome of 16 long-lanceolate, closely articulate teeth; the inner of a basal membrane about half the length of the teeth, bearing 16 lanceolate keeled segments alternating with the teeth, and often split along the keel, usually with 1–3 cilia between the segments. When fully developed these cilia are appendiculate, i. e., bear short transverse appendages at the articulations; the cilia are sometimes rudimentary and in a few species the inner peristome is adherent

to the outer. Growing on the ground, rocks and walls, rarely on wood of any sort. This is a very large and difficult genus.

The border often varies on the same leaf. Lower leaves of *Bryum* are usually shorter and broader than the upper leaves and always have a shorter costa. The inner comal leaves are usually larger and narrower than the general run of leaves on the plant. The border of a *Bryum* leaf is usually most distinct near the base and least distinct near the apex. In using the key, select leaves in the lower part of the upper third of the leafy portion of the stem and look for border in the upper third of the leaf. The margin of the leaves is frequently strongly recurved and gives the appearance of a margin whether a margin be really present or not. To make sure, the margin must be flattened out by manipulation with needles and pressure on the cover-glass. It may even be necessary to use scissors.

Some of the species vary in the characters used in the key, hence these species have to be included under more than one of the headings.

Height as used in keys and descriptions applies to the gametophyte only. The leaves in *Bryum* are markedly smaller than in *Mnium*, and the leaf cells are much more elongated. The capsules are usually more slender, longer necked and more pendent.

Pohlia (*Webera* of the L. & J. Manual) is so much like *Bryum* that a word of warning may not be out of place here. The leaf cells in *Pohlia* are much longer than in *Bryum*. *B. capillare* is frequently mistaken for *Mnium* because of its short leaf cells.

KEY

1—Leaves bordered 2
Leaves not bordered, at least in the upper half 7
2—Costa plainly vanishing below apex. (See also *B. capillare*) ..... *cyclophyllum*
Costa percurrent or excurrent in some of the leaves 3
3—Teeth of peristome with oblique or vertical lines connecting the transverse articulations; inner peristome without cilia, somewhat adherent to the outer ..... *pendulum*
Teeth of peristome without unusual markings; all rare; cilia lacking or rudimentary, not appendiculate; mouth of capsule oblique. ..... *uliginosum*
Teeth of peristome without unusual markings; cilia 2–4, nearly as long as the segments, usually appendiculate 4

4—Costa long excurrent; dioicous. (See *B. capillare*).....*caespiticium*
Costa long excurrent; synoicous.....*intermedium*
Costa percurrent or shortly excurrent..... 5
5—Leaves decurrent..... 6
Leaves not decurrent; dioicous.....*capillare*
6—Synoicous.....*bimum*
Dioicous.....*pseudotriquetrum*
7—Costa plainly vanishing below apex (plants silvery and shining when dry), common.....*argenteum*
Costa excurrent or percurrent..... 8
8—Synoicous.....*intermedium*
Dioicous.....*caespiticium*

SUBGENUS 1. CLADODIUM

Inner peristome more or less adherent to the outer, with cilia lacking or rudimentary; when present the cilia are not appendiculate.

Section 1. Ptychostomum

Outer teeth with irregular oblique or vertical lines on the inner surface, connecting the transverse articulations of the lower portion of the teeth.

B. pendulum (Hornsch.) Schimp. "About roots of trees in open woods, near Closter, N. J.," Musc. App. 196. Spring-summer.

Section 2. Eucladodium

Differing from Section 1 in the lack of oblique or vertical markings between the articulations of the teeth. The species of this section are rare and seldom collected.

B. uliginosum (Bruch) B. & S. Yonkers, E. C. Howe Bx!; Hoboken, N. J., Austin, Bx!; wet rocks near Haverstraw (N. Y.), Musc. App. 191. Late summer.

SUBGENUS 2. EUBRYUM

Peristome perfect, inner free from outer, cilia nearly or quite as long as segments, appendiculate. Spores smaller than in *Cladodium*.

Section 1. Leucodontium

Teeth of peristome pale yellow throughout, base of teeth scarcely thicker. (Though European authors emphasize the color of the teeth, I am unable to make use of it.)

B. cyclophyllum (Schwaegr.) B. & S. "About roots of trees subject to inundation in a swamp near Closter, N. J.," Musc. App. 192; Bronx Park, E. G. B., Bx!

Section 2. Pseudotriquetra

Plants robust (for the genus), with strongly decurrent leaves, which are rather sharply acuminate; costa usually excurrent, and leaf apex or excurrent costa serrate or toothed; peristome thickened and reddish at base. This last character is often obscure.

B. bimum Schreb. "Wet places, common," Musc. App. 194; "Wet rocks, Palisades, New Jersey," Musc. App. 195; frequent. Summer.

B. pseudotriquetrum (Hedw.) Schwaegr. "Moist rocks, very common in northern N. J. and southern N. Y.," Musc. App. 200; Palisades of N. J., Austin, Bx!

Section 3. Caespitibryum

Plants usually smaller than in the last section; leaves not decurrent, long acuminate, with costa excurrent. Peristome as in the last section.

B. caespiticium L. The most common of all our species, being found in rather dry soil in all kinds of situations, and on rocks and walls. Spring-summer.

B. intermedium Brid. Frequent. Spring–summer.

Section 4

The peristome in the following species has the characteristics of the two preceding sections. In this section I have put species which did not fit into any of the others.

B. capillare L. A species likely to be mistaken for a *Mnium*, as it is Mnium-like in habit and in shape and structure of leaves, but the capsule is typically that of *Bryum*, with neck one-half as long as the rest of the capsule, or longer. "Shaded banks and rocks, common but sterile in N. J.," Musc. App. 199; Eastchester and Bronx Park, E. G. B., Bx!

B. argenteum L. A small species, growing everywhere; usually in dense mats. It is especially fond of dry compact soil in sandy fields and waste places. It grows abundantly in paths and between the bricks of sidewalks in towns and cities. When full grown it is a bright silvery gray. Autumn.

RHODOBRYUM (Schimp.) Hampe

Nearly always dioicous. Very large plants, the largest and showiest of all this family. The stems spring from stolons, and are nearly leafless except at the summit, where the very large leaves form a rosette. Under favorable circumstances large mats are formed on old rotten logs or at the base of trees in rich peaty soil.

R. roseum (Weis.) Limpr. "On decayed wood, on the ground about the roots of trees and on moist rocks, frequent," Musc. App. 203. Apparently occasional about the city, Closter, Yonkers, Bronx Park; Todt Hill, S. Id.

Subfamily 2. Mnieae

Plants usually larger than in Subfamily 1, with larger broader leaves. Leaf cells nearly as broad as long. Plants rarely branching by innovations below the "flowers," frequently stoloniferous, *i. e.*, with prostrate or creeping sterile shoots that root at their tips. Capsules usually without appreciable neck; stomata usually immersed or partially so, rarely completely superficial.

MNIUM (Dill.) L. (Plate VII. Fig. 2.)

Plants usually large with large leaves, which are broadly oblong, or obovate to lingulate, the lower nearly always shorter and more rounded than the upper, usually with a strong distinct border which is often strongly toothed. Costa usually percurrent or nearly so, sometimes shortly excurrent. *Leaf cells rounded-hexagonal to quadrate-hexagonal*, somewhat larger and elongated at base, not papillose. Calyptra small, cucullate. Capsules oblong-cylindric to ovoid, pendent, *not pyriform;* operculum mammillate to rostrate. Peristome perfect; cilia often nodose but not appendiculate.

Nearly all the species are large handsome mosses, easily distinguished even when sterile. Moist shaded ground rich in humus, or much decayed wood in moist shaded places, are favorite habitats of the genus.

Rhodobryum roseum is the only plant likely to be confused with *Mnium*.

KEY

1—Leaves not bordered or border very slight 2
Leaves bordered 3
2—Plants large, leaves entire or very slightly serrate by projecting cells; leaf cells twice as long as broad, marginal cells linear ..... *cinclidioides*
Plants much smaller, leaves usually serrate; leaf cells isodiametric (*i. e.*, as broad as long) ..... *stellare*
3—Leaves entire 4
Leaves serrate, with single teeth 5
Leaves serrate, with teeth in pairs 8
4—Leaves costate to apex ..... *punctatum*
Costa vanishing below apex ..... *punctatum* var. *elatum*
5—Leaves serrate to base or nearly so; capsules clustered 6
Leaves serrate in the upper ½ or ⅔ only ..... *cuspidatum*
6—Teeth of leaf margins of 2–5 cells (except *affine rugicum*); operculum mammillate or apiculate 7
Teeth of leaf margins very short; operculum strongly beaked ..... *rostratum*
7—Dioicous; many marginal teeth of more than two cells ..... *affine*
Synoicous; marginal teeth shorter, few of more than two cells ..... *medium*
8—Costa vanishing below apex ..... *hornum*
Costa reaching apex in upper leaves 9
9—Costa toothed on the back; dioicous 11
Costa not toothed on the back; synoicous 10
10—Capsules sometimes clustered; peristome forming a conspicuous red-brown band around the mouth of the deoperculate capsule. *spinulosum*
Capsules not clustered; peristome yellowish to brownish ..... *marginatum*
11—Leaf cells hexagonal, small, about 12–15μ ..... *orthorrhynchum*
Leaf cells rounded at the corners, about 20μ ..... *lycopodioides*

A. SERRATAE. *Leaves bordered, serrate with single teeth.*

M. affine Bland. Much less frequent than the variety. Several localities on Staten Island, E. G. B. (Bx)!; "Common," Musc. App. 205; Bedford, E. G. B., Bx!

Var. ciliare (Grev.) CM. Frequent in damp shaded places. May.

Var. **rugicum** B. & S. Lawrence and Oyster Bay, L. Id!!, Bulls Head, S. Id.!!; Bronx Park, R. S. W. & E. G. B., Bx!

M. cuspidatum (L.) Leyss. (*M. sylvaticum* Lindb.). Common in damp shaded places. May.

M. medium B. & S. "? Wet rocks, Little Falls, N. J.," Musc. App. 206.

M. rostratum Schrad. "Wet rocks, Palisades and northern N. J. & southern N. Y., rare," Musc. App. 207; Jamaica (24807)!! Orient, Latham, on L. Id.; Princes Bay, S. Id. & Bronx Park, E. G. B., Bx!

B. Biserratae. *Leaves margined, serrate with double teeth.*

M. hornum L. Wet shaded places, especially along streams and around springs; common. April.

M. lycopodioides (Hook.) Schwaegr. "On shaded rocks, Northern N. J.; also on decayed logs in Herkimer Co., N. Y.," Musc. App. 208.

M. marginatum (Dicks.) P. B. "Shaded banks and crevices of rocks, Palisades and northern N. J.; scarce," Musc. App. 210.

M. orthorhynchum B. & S. Wallingford, Bry. Ct.

M. riparium Mitt. Rockland Co., N. Y. and Bergen Co., N. J., Austin. According to Mrs. Britton Austin's specimens are not this species.

M. spinulosum B. & S. "On rocks in a ravine at Godwinville, N. J., also on wooded banks, Rockland Co., N. Y.," Musc. App. 209; Darien, Bry. Ct.

C. Leaves bordered (slightly so in M. cinclidioides), entire.

M. punctatum L. Not reported from L. Id., frequent elsewhere; banks of rivulets. Early spring.

Var. **elatum** Schimp. Common in swampy places.

M. cinclidioides (Blytt.) Hueben. "Swamps and wet woods, Palisades (frequent), northern N. J. and southern N. Y.," Musc. App. 214 & 215.

D. Leaves not bordered, serrate.

M. stellare Reich. "On shaded cliffs and banks and about the roots of trees in swamps, rather frequent but rarely fertile," Musc. App. 216; Palisades, N. Y., E. G. B., Bx!

Subgroup. 2. Pleurocarpae

Sporophyte from a lateral bud on a branching prostrate or ascending plant; occasionally the plants are erect, as in *Climacium*. Peristome for the most part almost like that in the Bryaceae, except that in the Hypnaceae and some closely allied genera, the basal segments of the peristome teeth are ornamented by very fine transverse lines.

Family 21. LESKEACEAE

Mosses of varying habit and size, growing on shaded earth, stones, trunks of trees, or decayed wood, usually lusterless; main stems creeping with ascending or erect secondary stems. In *Thuidium* the stems are regularly pinnately branched and ascending, having somewhat the appearance of miniature ferns. Stem leaves often very different from the branch leaves, both strongly costate in most species, costa never excurrent; leaf cells rarely more than three times as long as broad, often less, mostly papillose, papillae often very large; leaf cells of the basal portion of the leaves more elongated and less strongly papillose, often smooth. Paraphyllia present in most species, varying in form but mostly slender and branched. Seta long, smooth, twisted when dry. Capsule erect and symmetric in most of our species, except in the genus *Thuidium*. *Thuidium* also has the perfect hypnaceous peristome, but most of the other genera illustrate well the degeneracy of the peristome in erect capsules, in which the cilia are usually vestigial or lacking and the segments often very narrow, or, in some cases, imperfect.

Key to the Genera

1—Plants regularly and pinnately branching, capsules usually curved with perfect peristomes. (See also *Claopodium*) ..... *Thuidium*

Secondary stems usually ascending from prostrate main stems, not regularly pinnate; peristomes usually imperfect, and capsules erect and symmetric 2

2—Plants bluish or glaucous green (scarcely so in *T. hirtella*); leaf papillae very large, often lobed or branched; paraphyllia lacking.. 3
Not bluish or glaucous green; papillae smaller, or rarely lacking; paraphyllia present except in *Anomodon* and part of *Leskea*..... 4
3—Costa short or double.....*Myurella*
Costa single, usually reaching the middle of the leaf.....*Thelia*
4—Costa double or short or almost lacking. (See also *Leskea denticulata*).....*Pterigynandrum*
Costa single, strong..... 5
5— ♀ buds and sporophytes borne on secondary stems; paraphyllia lacking.....*Anomodon*
♀ buds and sporophytes borne on primary stems; paraphyllia present in part of the species.....*Lindbergia* and *Leskea*

THUIDIUM B. & S. (Plate VIII.)

The *Thuidia* are widely distributed and have been noted by every lover of out-of-door life because of their delicate and beautiful fern-like form. The branches are given off very regularly like the pinnae of a fern, and the branches themselves often give off branchlets as regularly as the pinna of a fern is divided into pinnules.

The stems bear paraphyllia of various sizes and shapes, but all are more or less linear or filamentose, often divided and branched, but not leaf-like. There is often considerable difference between the stem and branch leaves in shape and size. The ovate-triangular stem leaves are usually papillose on both surfaces, unicostate, the costa passing the middle. The median leaf cells vary from roundish quadrate-hexagonal to rhombic-oblong; in two species linear-rhomboidal. The capsules, on smooth pedicels, are annulate, more or less curved. The opercula vary from conic to rostrate; the peristomes are well developed; the endostomial band ⅓ the length of the teeth, with segments and cilia.

Key

1—Apical cells of branch leaves crowned with 2–4 papillae; median cells quadrate-hexagonal to oblong-rhomboidal..... 2
Apical cells of branch leaves with a single terminal papilla; median cells as in 2. Paraphyllia numerous, branched..... 7
Apical cells of branch leaves not papillose; median leaf cells linear-rhomboidal. Paraphyllia long-linear or filamentose.....*paludosum*
2—Paraphyllia few, small, linear-oblong, 2–6 cells long; branch leaves subcrispate-incurved when dry..... 3
Paraphyllia numerous, more or less branched..... 4

3—Plants very small, 1–2 cm.; stem and branches filiform, branches papillose; growing in thin mats on limestone rocks..... *pygmaeum*
Plants small, 2–4 cm.; loosely caespitose; branches smooth; growing on the ground and rotten wood..... *minutulum*
4—Stems closely pinnately branched, branches terete-foliate when dry ... 5
Stems loosely pinnately or bipinnately branched..... 6
5—Plants soft; leaf cells with 2–5 small papillae on each surface.... *scitum*
Plants rigid; leaf cells with a single papilla on each surface..... *abietinum*
6—Pinnate or bipinnate; stem leaves spreading-recurved when moist, costa subpercurrent; perichaetial leaves not ciliate..... *recognitum*
Bipinnate or tripinnate; stem leaves erect spreading when moist, costate to 4/5; perichaetial leaves ciliate..... *delicatulum*
Bipinnate; stem leaves with a hyaline filiform acumination; perichaetial leaves scarcely ciliate..... *Philiberti*
7—Stem leaves roundish ovate, abruptly linear-oblong-acuminate, margins erose-serrate..... *virginianum*
Stem leaves broadly ovate, long and narrowly acuminate, margins crenulate-serrulate or entire..... *microphyllum*

T. abietinum (L.) B. & S. "On dry limestone ridges, Sussex Co., N. J., very abundant," Musc. App. 304; Yonkers, E. C. Howe, Bx!

T. delicatulum (L.) Mitt. On shaded rocks and banks; common. Winter.

T. microphyllum (Sw.) Best. "Woodbridge," Bry. Ct.

T. minutulum (Hedw.) B. & S. "On decayed wood in swamps; common," Musc. App. 297; Pleasant Plains, Court House and Woods of Arden, Mosses of S. Id.; Closter, Austin, and New Brunswick, N. J.; Vail. Autumn.

T. paludosum (Sull.) Rau & Hervey. Frequent in wooded swamps. Winter.

Var. **elodioides** (R. & C.) Best. Wet meadow, Oyster Bay, L. Id.!!

T. Philiberti Limpr. "Base of small trees in wet places, Stockton, N. J." G. N. Best, Bx!

T. pygmaeum B. & S. Closter, N. J., Austin, Bx!

T. recognitum (Hedw.) Lindb. This is reported from Richmond Hill and Northport, L. Id., from S. Id. and from N. J., but the identification of the specimens is uncertain.

T. scitum (Beauv.) Aust. "On base of trees near Closter, N. J.," Musc. App. 300; Flushing!! and Orient, L. Id.; New Dorp, Todt Hill and Tottenville, S. Id., E. G. B., Bx!; Palisades, state line, N. Y. & N. J., E. G. B., Bx! Autumn-winter.

Var. **aestivale** (Aust.) Best. "On roots of trees, N. J, & N. Y.; frequent," Musc. App. 301.

T. Virginianum (Brid.) Lindb. On dry sterile ground in open woods, also about the bases of trees; frequent. Spring.

CLAOPODIUM R. & C.

Plants variable in size. Stems creeping, radiculose, stoloniferous; stem leaves triangular to broadly ovate, long and narrowly acuminate, margins plane, dentate-serrate, costa translucent; leaf cells small, round-hexagonal to rhombic, thickened-papillate on both surfaces; dioicous. Seta rough; capsule horizontal; annulus compound; cilia 1–3; operculum long-conic to conic-rostrate. Differs from *Thuidium* in the absence of filamentose paraphyllia and from *Anomodon* in the curved capsules.

C. pellucinerve (Mitt.) Best. Noroton, Ct., Mrs. J. D. Lowe. *Fide* Dr. Best, Bryologist **6**: 39. 1903.

LESKEA Hedw.

Plants small to medium-sized, growing in tufts about the base of trees, on bark of lower trunk, on rotten wood, more rarely on stones or soil in damp shady places. Stems prostrate, usually radiculose, sometimes paraphyllose, pinnately to fasciculately branched, rarely stoloniferous; leaves often papillose, ovate to ovate-lanceolate, acute, acuminate or obtuse, usually unicostate, sometimes shortly bicostate, nearly or quite entire (excl. *L. denticulata*); leaf cells somewhat uniform, median quadrate-hexagonal to oval-oblong, rarely elongated; setae smooth; capsules *usually straight and erect*, sometimes curved, oval to subcylindric, annulate; teeth well developed; segments linear, often keeled and cleft; cilia usually none or rudimentary; opercula mammillate to long-conic, rarely rostellate; calyptra cucullate, smooth.

KEY

1—Leaves papillose, costate; median cells usually isodiametric; peristomial teeth abruptly incurved from a bulging base when dry...EULESKEA 2
Leaves smooth or nearly so, costate or ecostate; peristomial teeth erect when dry.....*denticulata.*
2—Leaves ovate-lanceolate, acute to acuminate, more than twice as long as wide.....3
Leaves ovate, subacute to obtuse, less than twice as long as wide.....4
3—Capsules straight (except var. *paludosa*); operculum short-conic *polycarpa*
Capsules curved; operculum long-conic.....*arenicola*
4—Leaves symmetric, biplicate, margins often revolute.....*gracilescens*
Leaves asymmetric, not plicate, margins plane.....*obscura*

L. arenicola Best. Rosemont and New Lisbon, N. J., Best. Probably frequent.

L. denticulata Sull. "On dry rocks and roots of trees, always sterile in N. Y. and N. J.," Musc. App. 267; Orange, Bry. Ct.*

L. gracilescens Hedw. Byram, Stockton, & Rosemont, N. J., Best; Toms River, N. J.!!, on shade trees in the street. Probably not rare about N. Y. City, but is little known.

L. obscura Ehrh. "On stones and roots of trees within the reach of floods; common," Musc. App. 270; Bronx Park, E. G. B. & R. S. W., Bx!; Willow Brook, S. Id.!!; Yonkers, Howe, and Closter, N. J., Austin, Bx!

L. polycarpa Ehrh. Bronx Park and S. Id., E. G. B., Bx!; Closter, N. J., Austin, Bx!

LINDBERGIA Kindb.

Differs from *Leskea* in having peristome teeth papillose, inner peristome a short basal membrane without teeth or cilia.

L. Austinii (Sull.) Broth. (*Leskea Austinii* Sull.). "On stone fences, Sussex Co., N. J.," Musc. App. 268.

PTERIGYNANDRUM Hedw.

Somewhat resembles *Leskea* in general appearance and inhabits similar places, roots and bases of trees, damp stones, etc.

* Brotherus in "*die Natürlichen Pflanzenfamilien*" puts this in the Entodontaceae (Entodonteae) as *Schwetschkeopsis denticulata* (Sull.) Broth.

It is distinguished from *Leskea* by the much shorter costa, which may be single and reach the middle of the leaf, or be shorter and double, or even almost wanting: leaves much narrowed at base, often obovate, very concave; inner peristome of 16 rather short linear to irregular segments, without basal membranes or cilia.

P. filiforme (Timm.) Hedw. "On rocks and roots of trees, Palisades, N. J.," Musc. App. 280.

ANOMODON Hook & Taylor. (Plate IX, Fig. 1.)

Much like *Leskea* in habit of growth but much larger and coarser (excl. *A. rostratus* and *A. tristis*), when fully developed growing in mats consisting of a network of nearly leafless primary stems growing close to the substratum and sending up secondary stems and branches in great numbers. The leaves described are those of the secondary stems and branches, those of the primary stems are usually quite different. The stems lack paraphyllia. The leaves are densely papillose on both sides and almost opaque, and have a single long, strong, pellucid costa (shorter in *tristis*); leaf cells irregularly hexagonal, a few in the median basal area usually elongated and pellucid. Capsules and peristome much as in *Leskea* but the former borne on the branches, the latter very brittle; inner peristome as a rule less developed than in *Leskea*. All our species are dioicous.

Key

1—Secondary stems and branches slender, usually julaceous when dry.. 2
Secondary stems and branches coarse, scarcely julaceous..... 3
2—Leaves slenderly acuminate, ending in a hair point; plants growing in moist places at base of trees and about ledges.....*rostratus*
Leaves narrowly lingulate from an ovate base, obtuse to apiculate; plants growing on bark of trees as a rule.....*tristis*
3—Secondary stems much branched as a rule, many branches attenuate to flagelliform; some of the leaves apiculate and toothed at the apex.....*attenuatus*
Secondary stems more sparingly branched, no attenuate branches.... 4
4—Upper portion of leaves lingulate-lanceolate, conspicuously tapering to the apex, somewhat contorted and crisped when dry, often secund: plants usually growing on rocks.....*viticulosus*
Upper portion of leaves lingulate and of nearly equal breadth, not secund; plants nearly always growing on bark of trees, stumps or logs..... 5

5—Leaves somewhat crisped when dry with points incurved, not decurrent, having large fimbriate-papillose auricles, often apiculate. *apiculatus*

Leaves scarcely contorted when dry, somewhat irregularly appressed, decurrent, without auricles, not apiculate..... *minor*

A. apiculatus B. & S. "Jordansville, N. Y.," Austin, Bx.!

A. attenuatus (Schreb.) Hueben. "About the roots of trees and on rocks, common," Musc. App. 274; New Lots, Jamaica, and Greenport on Long Id.; New Dorp, Bloodroot Valley and Tottenville on S. Id.; Williamsbridge, Bedford, East Chester and Yonkers, N. Y. Autumn–winter.

A. minor (P. B.) Fuern. "On roots of trees and on rocks, common," Musc. App. 275; Closter, N. J., 276 (as var. *fragilis*); New Lots (26295) and Jamaica (26294), Long Id., Brainerd; Bloodroot Valley, S. Id.!! Late autumn to winter.

A. rostratus (Hedw.) Schimp. About roots of trees, etc., in damp places, common. Autumn.

A. tristis (Cesat.) Sull. "On trees and rocks, common, always sterile," Musc. App. 273; New Dorp, S. Id., and Bronx Park, E. G. B., Bx!; Closter, N. J.,!! N. Am. Musc. Pl. 195.

A. viticulosus (L.) Hook and Taylor. "On limestone rocks, Sussex Co., N. J." Musc. App. 278.

THELIA Sull. (Plate IX, Fig. 2.)

Plants of this genus as a rule are easily recognized by the light color, *very light to glaucous-green*, and the rather *short crowded julaceous stems* from creeping primary stems. In depauperate or very young plants the branches are often scattered. Under the microscope the most striking thing is the *enormous single papilla* on the back of each leaf cell. The costa is usually single and extends about half the length of the leaf. Capsules ovoid-cylindric, operculum beaked; outer peristome teeth conspicuously whitish, slender; inner of a well developed basal membrane with segments very rudimentary or none.

1—Growing on rather dry sandy soil, rarely on bases of trees..... *Lescurii*

Growing on the base of trees, never on the ground..... 2

2—Plants distinctly glaucous; leaf *papillae forked*..... *asprella*

Plants scarcely or not at all glaucous; *papillae simple*..... *hirtella*

T. hirtella (Hedw.) Sull. Very common on bark of trees. Autumn.

T. asprella (Schimp.) Sull. Cold Spring (26126)!!; New Lots (26125) and Jamaica (26124), Brainerd, L. Id.! "On roots of trees, old stumps and on stones in open woods, common," Musc. App. 263; Alpine, N. J., Jelliffe, Bx!; Yonkers, Howe, Bx! Early autumn.

T. Lescurii Sull. "On flat rocks, Palisades. On white sand about base of stunted oaks in Southern N. J.," Musc. App. 264; sandy soil, Orient, Latham, and Rockaway and Lynbrook on L. Id. Rarely fruiting. Also found in southern Ct.

MYURELLA B. & S.

M. Careyana Sull. "Banks of ravines about Hohokus and in Mts. of N. J.," Musc. App. 265; Closter, N. J., Austin, Bx.!

M. julacea (Vill.) B. & S. occurs in the Del. Water Gap.

Family 22. HYPNACEAE

Plants creeping in habit, forming mats of more or less closely interwoven stems and branches, growing mainly on soil and rotten wood, less frequently but commonly on stones and trunks of trees, a few aquatic.

Leaves costate or ecostate, not papillose, except *Bryhnia* and *Hylocomium* species. Capsules on elongated setae more or less curved and unsymmetric except in the *Climacieae*, *Entodonteae* and a few anomalous mosses. Peristome usually perfect, the cilia often lacking in mosses with erect capsules, segments always keeled; teeth strongly articulate, marked at base between the articulations by characteristic fine transverse lines except in a few forms with erect capsules and degenerate peristomes. A very large family closely related to the *Leskeaceae*, from which it differs in the non-papillose (except *Bryhnia*) leaves and also usually in the longer leaf cells and unsymmetric cernuous capsules. The peristomes are very close to those of the *Bryaceae* except for the fine transverse lines on the peristome teeth.

This family is a large and somewhat heterogeneous one and includes practically all the pleurocarpous mosses with elongated smooth leaf cells and well developed peristomes, *i. e.*, having broad keeled segments and, usually, well developed cilia. Although the leaf cells are often short and broad, they are more or less rhomboidal or elongated-hexagonal in outline and in the middle of the leaf are never regularly oval, rounded, or quadrate.

The mosses of this family may be found in all kinds of habitats, and some individual species have a wide range of habitat.

The classification of this family is a matter upon which no two bryologists would be likely to agree. No single character can be relied upon as a basis of classification, and it is extremely difficult to select combinations of characters that will indicate relationships with any degree of accuracy. Many characters relied upon in the past are almost certainly very highly modified, if not actually produced, by habitat conditions. Short thick-walled leaf cells are so frequently correlated with a xerophytic habitat as to suggest a causal relation. There is almost certainly a relation between habitat and the curvature and direction assumed by the capsule, and between this last and the completeness of the peristome. These statements, of course, apply to mosses outside this family, but the difficulties in classification caused by these facts are particularly prominent here.

The following grouping into subfamilies is primarily based more on the structure and robustness of the costa and the presence or absence of central strand in the stems than in most of the older groupings. For exceptions to the characters indicated in this key see the descriptions of the subfamilies.

Key to the Subfamilies of the Hypnaceae

1—Costa strong and extending to the middle of the leaf or beyond, nearly always single, (exceptions in *Hylocomium* and *Campylium*) . . 3
Costa short and double or lacking 2
2—Capsules erect and symmetric, or nearly so; cilia of inner peristome rudimentary or lacking . . . . . *Entodonteae*
Capsules unsymmetric, more or less curved, usually cernuous . . *Hypneae*
3—Plants large, secondary stems stout and dendroid from creeping or stoloniferous primary stems 4
Plants smaller, scarcely dendroid 5

4—Capsules erect and symmetric; peristome without cilia..... *Climacieae*
Capsules curved, cernuous; peristome perfect..... *Porotricheae*
5—Capsules ovoid, short, thick and unsymmetric, usually little contracted under the mouth when dry; stem and branch leaves often quite different..... 6
Capsules longer, arcuate-cylindric as a rule, usually more contracted under the mouth when dry..... *Amblystegieae*
6—Costa single and usually reaching well beyond middle of leaf; seta often rough; paraphyllia lacking..... *Brachythecieae*
Costa frequently double, often short; paraphyllia large and abundant in many species; seta smooth..... *Hylocomieae*

Subfamily Hylocomieae

The characters of this subfamily are pretty well enumerated under *Hylocomium*. Its position is somewhat of a novelty as the usually double costa has caused it to be most frequently put with the *Hypneae*, yet the large and abundant paraphyllia of some of the species as well as gross appearance resemble the *Thuidia*, while the capsules are certainly more like the *Brachythecieae* than the *Hypneae*. The stems, moreover, possess a central strand.

Key to Genera

Leaves secund, strongly rugose; no paraphyllia..... *Rhytidium*
Leaves not secund nor rugose; paraphyllia very abundant in some species. *Hylocomium*

HYLOCOMIUM B. & S.

Large robust mosses growing in wide, loose patches, characteristically in cool moist woods (the name signifies "inhabitants of the wood"), of a various habit yet for the most part with a common facies that is more easily recognized than described. Some are complanately branched and regularly bi-pinnate after the manner of *Thuidium*, most are rather irregularly branched. A number of the species have the stems densely covered with large branched paraphyllia. Leaves usually large and strongly plicate to sulcate. Costa single and strong but never percurrent, or double and more or less well developed. This genus, *Hygrohypnum*, and *Campylium* contain species with the costa single and double or even wanting, yet the species of these genera that vary in the development of the costa and also in that of the central strand are often very closely related. This goes to show

conclusively that no single character can be relied upon for the purpose of classification but that all characters must be taken into consideration.

The leaf cells in this genus are narrowly linear, frequently papillose at the back of the leaf by the thickening of the angles of the cell walls as in *Bryhnia*, comparatively little differentiated at base and angles, usually somewhat shorter and broader and often colored. Our species are dioicous; capsules large, short, inclined and unsymmetric, much as in the *Brachytheciae:* peristome perfect with well-developed cilia.

KEY

1—Paraphyllia lacking 2
Paraphyllia present, usually very abundant 3
2—Stem leaves not plicate, strongly squarrose-recurved ..... *squarrosum*
Stem leaves plicate, widely spreading but not recurved ..... *triquetrum*
3—Plants regularly and closely bi-tri-pinnate ..... *proliferum*
Plants rather irregularly branched ..... *brevirostre*

H. brevirostre (Ehrh.) B. & S. "Deep shaded ravines and swamps. Sterile in N. J.," Musc. App. 448; Little Falls, N. J., Austin, Bx!

H. proliferum (L.) Lindb. (*H. splendens* B. & S.). Rare. "Northport, Sanial," Flora L. Id. "On the ground in woods, northern N. J.," Musc. App. 447. Spring.

H. squarrosum (L.) B. & S. Hamden, Bry. Ct.

H. triquetrum (L.) B. & S. New Lots and Partegat (27226), Brainerd, and Northport, Sanial, on L. Id. "Common, sterile in N. J.," Musc. App. 449; Kreischersville, S. Id., Hollick and Britton, Bx!, "Four Corners," Mosses S. Id. Winter–spring.

RHYTIDIUM (Sull.) Kindb.

R. rugosum (L.) Kindb. Dry bluffs and ledges. Palisades, N. J., Austin, Bx.!; "Common, sterile," Musc. App. 450.

SUBFAMILY BRACHYTHECIEAE

Hypnaceous mosses differing but little in general appearance from many of the *Hypneae*, nearly always more or less glossy. The leaves are straight and imbricated when dry, occasionally

loosely spreading, erect-open when moist. Very rarely falcate or secund except in *B. velutinum* and its allies, often strongly plicate or sulcate, at least when dry, simply costate half way or more, leaf-cells linear-vermicular (except *B. reflexum*, *B. digastrum* and *B. cyrtophyllum*). Alar cells differentiated, often inflated and hyaline, sometimes quadrate and densely chlorophyllose.

Capsules brown to chestnut-brown, ovoid, short, cernuous and unsymmetric except in *Homalotheciella* and in *B. oxycladon*, and *B. acuminatum* and its allies, rarely or never plicate or strongly contracted under the mouth when dry; operculum conic, conic-apiculate or long-rostrate, seta often roughened with prominent papillae; peristome perfect except in species having erect capsules.

KEY TO THE GENERA

1—Operculum with very long, needle-like beak 2
Operculum conic or at most with a very short beak 3
2—Apices of branch leaves abruptly long-acuminate from a spoon-shaped base, apical cells not broader or shorter than the median. *Cirriphyllum*
Apices of branch leaves acute to obtusely-acute, with apical cells broader and shorter than the median (except *E. serrulatum*). *Eurhynchium*
3—Leaves markedly papillose on the back with projections from the angles of the cell walls; seta rough ..... *Bryhnia*
Leaves not papillose, seta rough or smooth 4
4—Leaves all elongated-lanceolate, very strongly sulcate with numerous folds; plants very glossy, golden green ..... *Camptothecium*
Leaves broader, less strongly sulcate or even smooth, less glossy 5
5—Calyptra smooth; inner peristome free ..... *Brachythecium*
Calyptra hairy; inner peristome adherent to teeth ..... *Homalotheciella*

BRACHYTHECIUM

Plants mostly of medium size and typically hypnaceous habit, very rarely pinnately branching with any degree of regularity. Branch leaves acute to acuminate, never obtuse, usually somewhat concave and often plicate or sulcate, costate to above the middle, median leaf cells sinuous-linear to linear-rhomboidal (broader and shorter in *B. reflexum*, *B. digastrum* and in some leaves of *B. cyrtophyllum*), basal cells broader and shorter, alar quadrate, rarely inflated and hyaline.

Stem leaves notably different in most species, larger and proportionately broader, often more slenderly acuminate and less strongly serrate; seta smooth to very rough, twisted to the right, capsules short-ovoid to oblong-ovoid, cernuous-arcuate and 2–4: 1 (cylindric in *B. oxycladon* and nearly erect and symmetric in *B. acuminatum* and *B. cyrtophyllum*), slightly contracted under the mouth when dry and empty, operculum conic to short rostrate; peristome characteristically hypnaceous and perfect except in the species with erect capsules. When in fruit this genus is easily recognized in most cases by the short, thick, dark-colored capsules which are usually unsymmetric and horizontal; spores almost without exception maturing in late autumn or early winter.

The grouping of species given below is a little different from that given in my monograph of the genus, in Vol. VI of the Memoirs of the Torrey Botanical Club, but represents opinions based on a great deal of additional study.

(1) The Salebrosum group consisting of *B. salebrosum*, *B. flexicaule*, *B. acutum*, *B. campestre*, *B. oxycladon*, and *B. digastrum*.

This group is characterized by smooth seta (except *B. campestre*), leaves plicate or sulcate when dry (except *B. acutum*), slenderly acuminate, concave and excavate at basal angles with the margins turned back parallel to the plane of the leaf (or reflexed in the ordinary descriptive language) in the lower portion; basal cells broader and shorter, quadrate alar cells numerous, hyaline or slightly chlorophyllose, stem-leaves ovate-lanceolate; annulus poorly developed, fairly well developed in *B. acutum*.

(2) The Rutabulum group including *B. rutabulum*, *B. rivulare*, and *B. Starkei*,, characterized by rough setae, well-developed annulus, ovate-deltoid stem leaves, all leaves less concave and alar cells less numerous, except in *B. rivulare*.

(3) The Acuminatum group resembling the salebrosum group in gametophyte characters but with nearly erect symmetric capsules and peristomes without cilia, consisting of *B. acuminatum*, *B. cyrtophyllum* and some southern species.

(4) The Plumosum group including *B. plumosum* and *B. populeum*, characterized by rough setae and densely chlorophyllose quadrate alar cells.

(5) The Velutinum group including *B. velutinum*, *B. erythrorrhizon* and a number of western species, characterized by small size and in our species by somewhat secund leaves.

KEY

1—Costa percurrent or nearly so ..... *populeum*
Costa extending ½–⅔ the length of the leaf 2
2—Seta smooth 3
Seta rough above, smooth below 9
Seta rough throughout 10
3—Capsules erect and symmetric or nearly so, cilia of peristome rudimentary or lacking 4
Capsules more or less cernuous and inclined, unsymmetric, cilia well developed 5
4—Plants very slender, leaves rarely more than 0.7 mm. long. *cyrtophyllum*
Plants with the facies and size of *B. oxycladon;* leaves 1–1.6 mm. long ..... *acuminatum*
5—Capsules suberect, 3–4: 1 ..... *oxycladon*
Capsules strongly inclined, and unsymmetric, 2–3: 1 6
6—Leaves not plicate or striate; stem leaves gradually narrowed from base to apex ..... *acutum*
Leaves plicate or striate 7
7—Stem leaves lanceolate, 0.6 mm. broad at base, gradually and evenly narrowed from base to apex ..... *flexicaule*
Stem leaves ovate, at least 1 mm. broad at base, more abruptly narrowed to a slender acumination 8
8—Stem leaves ovate-lanceolate, 2–2.5 by 0.8–1.1 mm., median leaf cells 10:1 ..... *salebrosum*
Stem leaves triangular-ovate, 1.2–0.8 mm., median cells 4–6: 1 .. *digastrum*
9—Leaves plicate, long acuminate, branch leaves strongly serrate .. *campestre*
Leaves not plicate, shorter-acuminate branch leaves entire or serrate. *plumosum*
10—Secondary stems often dendroid, stem leaves ovate and very short-pointed with enlarged and inflated alar cells ..... *rivulare*
Not dendroid, stem leaves slenderly acuminate 11
11—Slender; leaves somewhat secund, in most American plants, stem leaves lanceolate ..... *velutinum*
Robust; leaves not secund, stem leaves ovate to triangular-ovate 12
12—Complanate-foliate like a *Plagiothecium;* leaves cordate-triangular and strongly and widely decurrent; cilia of inner peristome appendiculate ..... *Starkei*
Not flattened; leaves ovate and less strongly decurrent; cilia not appendiculate ..... *rutabulum*

B. acuminatum (Hedw.) Kindb. "Centreport, Sanial," Flora L. Id.; Grant City, S. Id., E. G. B., Bx!; Closter, N. J., Austin, Bx!; Yonkers, Southworth, Bx! Autumn.

B. acutum (Mitt.) Sull. "On the ground in swamps near Closter, N. J.," Musc. App. 316; Noroton, Ct., Mrs. J. D. Lowe!!; Valley Stream and Flushing (N. Am. Musci Pl. 213), L. Id.!! On rotten wood in swamps; autumn-winter.

B. campestre B. & S. "On the ground in woods and under shrubbery in yards and gardens, Closter and northern N. J. and southern N. Y.," Musc. App. 314 & 315. Probably frequent but scarcely to be distinguished when sterile. Autumn-winter.

B. cyrtophyllum Kindb. "About roots of trees and on stone fences along dusty highways," Musc. App. 311, as *B. acuminatum setosum.* Undoubtedly from N. J.

B. digastrum C. M. & Kindb. I have this from Kingston, N. Y., coll. M. E. Williams, and it undoubtedly occurs near N. Y. City but has not thus far been recognized.

B. flexicaule R. & C. Jamaica, L. Id.!! A subspecies of *B. salebrosum.*

(*B. Noveboracense* Grout from Valley Stream L. Id. is apparently a freak form of *B. rutabulum* or a hybrid between this and *B. rivulare.*)

B. oxycladon (Brid.) J. & S. Damp soil and rocks. Frequent. Autumn–winter.

Var. **dentatum** (L. & J.) Grout. Bloodroot Valley and Moravian Cemetery, S. Id.!!; Bronx Park, E. G. B.!!

B. plumosum (Sw.) B. & S. Common on wet ground in swamps and on wet stones in and around streams and swamps. Autumn.

B. populeum (Hedw.) B. & S. Usually on rocks. Jamaica and Forest Park!!, Flatbush, Brainerd (28248), Brooklyn, Capt. Pike, Bx!, from L. Id.; New Dorp and Princes Bay, S. Id., E. G. B., Bx!; Yonkers, Howe, Bx!; "Same as last," Musc. App. 328, that is to say "Common."

B. rivulare B. & S. Common in brooks and pools and on wet ground and stones. Early autumn.

B. rutabulum B. & S. Common on ground and stones in wet or swampy places. Early winter. A variety approaching *B. rivulare* from S. Id. was issued as No. 421, N. Am. Musci Pl.

Var. **turgescens** Limpr. Swamp, New Dorp, S. Id.!!

B. salebrosum (Hoffm.) B. & S. Common, occurring on all sorts of substrata in rather damp places. Autumn–winter.

B. Starkei (Brid.) B. & S. "Greenwood Mts. and Delaware Water Gap, N. J.," Musc. App. 323. "Darien, Mrs. J. D. Lowe," Bry. Ct.

B. velutinum (L.) B. & S. On soil and stones, Orient, Latham, Prospect Park!!, and New Lots, Brainerd (26014), on L. Id.; Closter, N. J., Austin!!; Clifton, N. J., Nash, Bx!

BRYHNIA Kaurin

Closely related to *Brachythecium*, but distinguished by shorter leaf cells (4–6: 1), papillose at the angles by the projecting cell walls. The papillae are sometimes wanting in *B. Novae-Angliae* which leads M. Cardot to refuse this group generic rank.

Key

Branch leaves acute to short acuminate, apex twisted ..... *Novae-Angliae*
Branch leaves longer acuminate, apex not twisted ..... *graminicolor*

B. Novae-Angliae (Sull. & Lesq.) Grout. (*Hypnum Novae-Angliae* Sull. & Lesq.) Common on soil in swamps. Winter.

B. graminicolor (Brid.) Grout. "On banks of deep shaded ravines, common but rarely fertile," Musc. App. 334; Egbertville, S. Id., E. G. B., Bx!; "Bath, Brainerd," Flora L. Id.; Canaan, Ct., Nichols, Bx!

CAMPTOTHECIUM B. & S.

Plants closely allied to *Brachythecium* but for the most part distinct to the casual observer by reason of the *bright golden or yellowish green silky luster and strongly plicate leaves*, which are usually slender and have as a rule narrower leaf cells; seta rough or smooth. Our only species is:

C. nitens (Schreb.) Schimp "Peat bogs, near Sparta, N. J." musc. App. 307. Should be found nearer in cool bogs.

CIRRIPHYLLUM Grout

Robust glossy mosses resembling *Eurhynchium* in the long-beaked opercula and other capsule characters, but resembling *Brachythecium* in their general leaf characters; leaves imbricate, very concave, *spoon-shaped*, often cucullate at the apex, abruptly drawn out *into a long-filiform acumination*, costate to the middle or beyond. Branches *julaceous*, usually *turgid in appearance*, due to the concavity of the imbricated leaves.

The species I have included here have usually been referred to *Eurhynchium*, but are so distinct in leaf form and structure that they are best treated separately.

C. Boscii (Schwaegr.) Grout (*Hypnum Boscii* Schwaegr.). Common on soil almost everywhere, especially in shaded grassy places but often depauperate and difficult to recognize. Autumn.

C. piliferum (Schreb.) Grout. Closter, N. J., Austin, Bx.! "On ground about roots of trees and on old logs in swampy places, N. J.," Musc. App. 336.

EURHYNCHIUM B. & S. (Plate X.)

Resembling *Brachythecium* in general appearance; leaves costate to the middle or beyond, apical cells of branch leaves *much broader and shorter than the* median in *some* species, in others as long or longer. Stem leaves acute to long and slenderly acuminate; sporophyte as in *Brachythecium*, except for the long-beaked operculum, the beak being $\frac{1}{3}$–$\frac{1}{2}$ the length of the rest of the capsule.

The meaning and origin of the fantastic needle-like beak on the operculum in this and many other species of mosses, notably *Dicranum*, is a great puzzle. That it can be of any use so as to be favored by natural selection seems improbable. The only possible utility that I can imagine is that it serves to aid in dehiscence, causing the operculum to be knocked off more readily. As every collector knows, it is rather a difficult matter to find matured capsules of these long-beaked species in good condition and keep them so in the herbarium. One year I collected *E. rusciforme* on August 15 in excellent condition, but apparently immature. When I collected for my North American

Musci Pleurocarpi, I collected three weeks later and most of the opercula had fallen.

KEY

1—Apical cells of branch leaves oblong-rhomboidal to circular 2
Apical cells of branch leaves not materially different from the median cells ..... *serrulatum*
2—Aquatic or subaquatic ..... *rusciforme*
Terrestrial 3
3—Seta rough ..... *hians*
Seta smooth ..... *strigosum*

E. hians (Hedw.) J. & S. Common on sandy soil especially in woods, but mostly sterile. Late autumn.

E. rusciforme (Neck.) Milde. "On rocks in rapid streams, common," Musc. App. 347. Closter, N. J., Bx!, near Northvale, N. J.!!; Princes Bay, S. Id., E. G. B., Bx!; Yonkers, Howe, Bx!; Palisades, N. Y., R. S. W. & E. G. B., Bx! August.

E. serrulatum (Hedw.) Kindb. Common on shaded soil, especially at base of trees. Sept.–Oct.

E. strigosum (Hoffm.) B. & S. var. **robustum** Roell. "On banks in woods, common," Musc. App. 332. Not common according to my experience. Ridgewood, New Utrecht, Northport, Orient, on L. Id.; S. Id., Palisades, East Chester, Bronxville, E. G. B., Bx!; Yonkers, Howe.

Var. **praecox** (Hedw.) Husnot. New Utrecht and New Lots, Brainerd (H. S.)!; Prospect Park!! and Cold Spring!!; all from L. Id. "On shaded banks, common," Musc. App. 333 (as *E. diversifolium*); Egbertville and New Dorp, S. Id., E. G. B., Bx!; Hampton Court, Richmond, S. Id.!!

Var. **scabrisetum** Grout. Type from Palisades, N. J., also from Byram, N. J., Best.

HOMALOTHECIELLA Cardot.

Homalotheciella differs from *Euhomalothecium* Card. in its small size and concave nonplicate leaves. From *Brachythecium* it differs in the hairy calyptra and imperfect peristome. The plants have almost the appearance of a *Pylaisia*. The resemblance is all the more striking because the segments of the

endostome adhere to the teeth as in *Pylaisia intricata* (Hedw.) R. & C. One cannot help wondering if the similarity between *Pylaisia, Platygyrium* and this species is not due to the fact of their having a similar habitat. May it not be that their approach in capsule to *Leskea, Leucodon, Anomodon*, etc., is due to the same cause?

H. subcapillata (Hedw.) Card. (*Homalothecium subcapillatum* Sull.). "On trees, common," Musc. App. 295; Palisades, N. J., Austin, Bx!

Subfamily Climaceae

Characterized by the dendroid habit, strongly costate leaves, erect symmetric capsules and well developed peristome, lacking both cilia and the fine transverse markings on the base of the peristome. We have but one genus.

CLIMACIUM Web. & Mohr.

Large handsome mosses with a tree-like habit of growth from underground creeping stems. Sometimes prostrate, or floating in very wet places. Stem and branches bearing paraphyllia. The leaves are all somewhat decurrent but vary greatly in shape and structure. The leaves of the main upright stems are very large, thin, with little chlorophyll, closely imbricated and clasping. Branch leaves smaller, of a different shape and texture, chlorophyllose. All our species are dioicous. The seta is long and smooth, twisted to the right when dry. Calyptra split on one side, long, reaching to the base of the capsule. Capsule erect, cylindric; operculum conic-rostrate with the beak often oblique; annulus none; peristome double; teeth linear-lanceolate, very long, closely articulate, minutely papillose; segments as long as the teeth, keeled, split between the articulations, often split to the apex when old, united at the base into a continuous narrow basal membrane, minutely papillose.

Mosses of swampy woods and fields; fruiting with comparative infrequency. The systematic position of this genus is as yet doubtful. It certainly does not belong in the *Entodonteae*, where it has previously been placed.

Key

1—Capsules 3 to 4 times as long as broad; median leaf cells 10 times as long as broad ..... *dendroides*
Capsules 5–6: 1; median leaf cells not more than 7: 1 2
2—Plants of a distinctly tree-like habit; median leaf cells 5–7: 1. *Americanum*
Plants growing in dense tufts so that the tree-like habit is obscured, or prostrate and hypnoid in appearance; median leaf cells 2–3: 1. *Kindbergii*

C. Americanum Brid. Frequent on soil in moist shaded places but fruiting sparingly. Autumn.

C. Kindbergii (R. & C.) Grout. Common in swamps, often growing in water. Autumn.

C. dendroides (L.) Web. & Mohr. Yonkers, E. C. Howe, Bx!; "in swamps about Closter, N. J.," Musc. App. 286.

Subfamily Porotricheae

Plants dendroid in habit. Leaf cells short and broad. Capsules unsymmetric and inclined, with a perfect hypnaceous peristome. Brotherus in "Die Natürlichen Pflanzenfamilien" puts this subfamily in the *Neckeraceae*, an arrangement with which I am compelled thoroughly to disagree. All the characters, of our species at least, are hypnaceous except, possibly, the areolation. We have one genus,

POROTRICHUM Brid. (*Thamnium* B. & S.)

P. Alleghaniense (C. M.) Grout. Palisades, N. Y., R. S. W. Bx!; deep shaded crevices in wet rocks, Closter, N. J., Austin, Bx!; "Palisades, not rare," Musc. App. 337.

Subfamily Amblystegieae

Plants of various habits and habitats. Central strand and costa nearly always present (except *Campylium* species). Paraphyllia rarely present (except in *Cratoneuron*). Seta smooth, capsules oblong to subcylindric, cernuous, more or less curved and unsymmetric, usually contracted under the mouth when dry and empty. Leaves acute to slenderly acuminate (except *Calliergon*).

KEY

1—Leaves with a distinct border joined with the costa at apex..*Sciaromium*
Leaves not bordered..... 2
2—Leaves blunt and rounded at apex.....*Calliergon*
Leaves acute to acuminate..... 3
3—Leaf cells very long and narrow (except forms of *D. aduncus*); leaves more or less falcate-secund.....*Drepanocladus*
Leaf cells much shorter: leaves rarely falcate-secund (except *Cratoneuron*)..... 4
4—Paraphyllia abundant; plants plainly pinnately branched..*Cratoneuron*
Paraphyllia very few or lacking..... 5
5—Leaves widely spreading to squarrose-recurved (except *polyganum*); leaf cells usually more than six times as long as broad.....*Campylium*
Leaves not squarrose-recurved; leaf cells usually less than six times as long as broad.....*Amblystegium*

AMBLYSTEGIUM B. & S.

Mostly small moisture-loving mosses, growing on various substrata; variously colored, dark green to yellowish, sometimes blackish in the older portions, not glossy. Stems creeping, branching freely and irregularly; central strand present, few-celled. Leaves spreading to erect when dry, mostly equally spreading, but occasionally somewhat secund, more or less decurrent, lanceolate to ovate, acute to long-acuminate, strongly costate, flat or concave, but not plicate, margins plane. Leaf cells short, often less than 5: 1 (longer in *A. vacillans* and *A. riparium);* basal cells shorter and broader and parenchymatous; alar often somewhat enlarged, but not abruptly so, not inflated or forming auricles except *A. filicinum.* Paraphyllia few or more often wanting. Nearly always monoicous. Seta long, smooth; *capsules often large in comparison with the gametophyte,* inclined to horizontal, elongated and *usually strongly curved and constricted under the mouth when dry and empty;* operculum conical, not rostrate; annulus usually present; peristome perfect. The genus as here defined does not include the small species having ecostate leaves. They belong in the *Hypneae.*

The short leaf cells and long capsules, together with the usually small size of the plants, render this genus fairly easy of recognition, but the species, like most aquatic and subaquatic mosses, are exceedingly variable and puzzling.

KEY

1—Paraphyllia abundant, alar cells inflated ..... *filicinum*
Paraphyllia few or wanting, alar cells not distinctly inflated 2
2—Costa percurrent or nearly so, or excurrent 3
Costa ending well below the apex, usually not far above the middle .. 6
3—Stem leaves entire, cordate-ovate to oblong-lanceolate, apex rather blunt; all forms aquatic 5
Stem leaves narrower in outline, usually acute with a more slender acumen; growing in water or wet places 4
4—Aquatic, submerged except at low water; basal leaf cells usually plainly enlarged; costa very stout ..... *irriguum*
Growing in wet places but not often submerged; basal cells much less differentiated; costa more slender and apex usually more slenderly acuminate ..... *varium*
5—Stem leaves oblong-ovate to broadly oblong-lanceolate, 1–2 mm. in length, gradually and evenly narrowed to a rather blunt apex. *fluviatile*
Stem leaves ovate to cordate-ovate, usually less than 1.2 mm. long, more abruptly narrowed to a distinct acumination ..... *orthocladon*
6—Median leaf cells reaching 10: 1 or longer ..... *riparium*
Median leaf cells less than 8: 1 10
10—Leaves widely spreading when dry; marginal cells at base of leaf oblong to rectangular 11
Leaves not widely spreading; marginal cells at base quadrate or transversely elongated ..... *serpens*
11—Stem leaves 1 mm. in length or less, rarely more, ovate-lanceolate. *Juratzkanum*
Stem leaves more than 1 mm. in length; leaves broadly ovate-lanceolate to cordate-ovate ..... *Kochii*

The genus as here constituted divides itself pretty clearly into three subgenera.

Euamblystegium Broth., of which *A. serpens* is the center. Slender plants, not aquatic; leaf cells 2–6: 1, rarely longer; costa slender, reaching to the middle of the leaf or a little farther (to the apex in *compactum*).

This group includes *serpens*, *Juratzkanum*, *Kochii* and *compactum*. *Kochii* is usually put with the next group, but its nearness to *Juratzkanum* and its wide leaf cells convince me that it belongs here.

Leptodictyum Schimp. contains *A. riparium* and its allied *vacillans*. The group is characterized by a generally aquatic or subaquatic habitat, long, narrow leaf cells, 8: 1, sometimes 10–15: 1, and the costa ending at about the middle of the leaf.

Hygroamblystegium Loeske, which Brotherus makes a separate genus, contains *varium*, *irriguum*, *fluviatile*, *orthocladon*, *noterophilum* and *filicinum*, and is characterized by aquatic habitat (excl. *varium*) and stout, percurrent or excurrent costa; leaf cells 2–4: 1, occasionally 6: 1, thick-walled; paraphyllia present in many species.

A. filicinum (L.) De Not. In wet woods, New Dorp, Court House, and Princes Bay, S. Id., Bx!; "Moist rocks and banks in limestone regions, common," Musc. App. 413; Little Falls and Sussex Co., N. J., Austin, Bx!; Bedford, E. G. B. Spring.

A. fluviatile (Sw.) B. & S. "On rocks in a rivulet near Closter, N. J.," Musc. App. 386; Willow Brook near Merritt Ave. and spring, Hampton Court!! S. Id.; and West New Brighton, Mosses of S. Id.; Bronx Park, E. G. B. & R. S. W., Bx! Summer.

A. irriguum (Wils.) B. & S. "Common," Musc. App. 376 and 379, also 360 as *A. serpens orthocladon*. Cool brooks, New Dorp, Princes Bay, Bulls Head, S. Id.; Cold Spring and Oyster Bay, L. Id.!! Summer. Forma *Marianopolitana* Dupret. Water in swamp, Bulls Head, S. Id.!!

A. Juratzkanum Schimp. On rotten wood, Cold Spring, L. Id.; Richmond, S. Id.!! Early summer. Probably frequent but hard to identify.

A. Kochii B. & S. Moist shaded soil. Common probably. Yard, 360 Lenox Rd. & Prospect Park, Brooklyn!!, New Lots, L. Id.; Swamp at New Dorp and at Richmond, S. Id.!!

A. orthocladon (P. B.) Kindb. On stones in brooks. Cold Spring, L. Id. (N. Am. Musci Pl. 189a); Fresh Kills Bridge and Willow Brook, S. Id.!!

A. riparium B. & S. Frequent in and near water. Spring.

Var. **longifolium** (Schultz) B. & S. Orient, L. Id., Latham.

A. serpens (L.) B. & S. Common on the ground and rotten wood in damp places. Spring. Musc. App. 373–384 are so confused as to be difficult to cite.

A. varium (Hedw.) Lindb. Frequent in moist shaded places. Spring.

SCIAROMIUM Mitt.

Distinguished from *Hygroamblystegium* chiefly by the strongly bordered leaves and entire lack of paraphyllia. In habitat and gross appearance it is the same, also in the cellular structure of the leaves.

S. Lescurii (Sull.) Broth. Stones in brooks, often with *Amblystegium orthocladon* or *A. irriguum*. Rare. Cold Spring!! L. Id.; "On rocks in mountain rivulets, N. J. & N. Y.," Musc. App. 371. Spring.

CAMPYLIUM (Sull.) Bryhn

Plants growing in moist places, frequently in or near water, usually over earth or stones (except *C. hispidulum*). The genus is closely allied to *Amblystegium*, from which it differs in the longer leaf cells and typically squarrose to squarrose-recurved leaves. The leaves are rarely somewhat secund, never falcate-secund or circinate. Branching usually irregular. Central strand of few cells. Leaves broadly lanceolate to ovate-lanceolate, usually long-acuminate and decurrent; alar cells somewhat differentiated, quadrate to hyaline-inflated. Costa usually single, double or lacking in some species, never percurrent or excurrent. Capsules inclined to horizontal, curved and usually contracted under the mouth when dry and empty. Annulus present; peristome perfect.

Key

1—Leaves strongly squarrose 2
Leaves not noticeably squarrose 4
2—Leaves strongly costate ..... *chrysophyllum*
Leaves without costa or with costa short and double 3
3—Plants very slender; alar cells not conspicuously enlarged or inflated ..... *hispidulum*
Plants stouter; alar cells conspicuously enlarged and inflated ..... *stellatum*
4—Stem leaves cordate-ovate, abruptly slenderly acuminate; dioicous. *radicale*
Stem leaves broadly lanceolate, gradually narrowed to a very long slender acumination; monoicous ..... *polygamum*

Amblystegium Juratzkanum and *A. Kochii* may be sought in *Campylium*, but their leaves are spreading from the base and not bent, consequently they will lie flat on a slide while the

species of *Campylium* most likely to be confused with them will not do so.

Plagiothecium striatellum may be sought here, as it has the appearance of a *Campylium*, but the stem is without central strand, the leaves are serrate and the capsules strongly striate when dry.

C. chrysophyllum (Brid.) Bryhn. "Very common," Musc. App. 394. Most of our material is forma *intermedia* Grout. Musc. App. 396 (as var. *rupestre*) is very close to the typical form. Early summer, common on moist shaded soil.

C. hispidulum (Brid.) Mitt. Near or on the ground in moist shaded places. "Common," Musc. App. 392; Garretsons, Princes Bay, Richmond, S. Id., E. G. B.; Yonkers, Howe; Closter, N. J., Austin; Centreport, L. Id., Sanial. Forma *compacta* Grout, Hempstead, L. Id. (type locality). Summer.

C. polygamum (B. & S.) Bryhn. "Swamps about Closter, N. J., rare," Musc. App. 401.

C. radicale (P. B.) Grout. Frequent on soil in swampy woods. "Very common," Musc. App. 391 (as *Hypnum bergenense* Aust.).

C. stellatum (Schreb.) Bryhn. "Wet meadows near Closter, N. J.," Musc. App. 399. Fredon, N. J. Wiegmann, June.

Var. **protensum** (Brid.) Roehl. Closter, Austin, Bx!

DREPANOCLADUS C. M. (Plate XI.)

Of all the mosses this genus is probably the most difficult because of the extreme variability of the plants. Even the recognized authorities in the group identify many specimens by telling what they are nearest rather than by referring them definitely to a described form. Nearly all grow in water or very wet places and the amount of water and other conditions of their immediate environment appear to modify their growth profoundly. Sometimes two well marked varieties can be found on the same plant. So variable are the leaves that it is absolutely necessary to take fully developed leaves from the older portions of the stem for purposes of study and comparison. In

removing these, great care must be taken to get all of the leaf as the characteristic swollen alar cells often remain attached to the stems.

Plants slender to very robust, without paraphyllia (there are a few inconspicuous paraphyllia in *D. uncinatus*). Leaves falcate-secund to circinate, often forming conspicuous hooks at the ends of the stem and branches, not papillose, nearly always longly and slenderly acuminate; costa single and well developed, reaching well into the upper ⅓ of the leaf; leaf cells very long and narrowly linear (shorter in forms of *aduncus*); alar cells in most species enlarged and inflated, forming more or less conspicuous decurrent auricles; basal cells usually shorter and thicker walled, often porose. Capsules inclined to horizontal, subcylindric and curved, usually somewhat contracted under the mouth when dry, with a perfect hypnaceous peristome.

KEY

1—Leaves entire (excl. forms of *revolvens*), somewhat narrowed to the nearly straight insertion, with no enlarged or decurrent alar cells but with a row or two of thick-walled broader and shorter cells across the base 2
Leaves with alar cells distinctly enlarged and inflated; often decurrent or plainly serrate or both 3
2—Plants robust, the older portions usually a deep reddish purple; stems with a central strand; leaves not plicate ..... *revolvens*
Plants as a rule more slender and less deeply colored; central strand lacking; leaves plicate ..... *vernicosus*
3—Leaves entire; alar cells usually greatly enlarged and inflated .. *aduncus*
Leaves, some or all plainly dentate 4
4—Leaves strongly plicate even when moist ..... *uncinatus*
Leaves not plicate; alar cells more or less inflated ..... *fluitans*

D. aduncus (Hedw.) Warnst. Infrequent except in N. J. Austin gives varieties from Little Falls, Musc. App. 405, var. 1, which is probably var. *gracilescens;* No. 407 which is labeled var. *gracilescens* is not this var. It may be var. *aquaticus.* Austin calls this form common. Var. *gracilescens* (Sch.) is reported also from Orient, L. Id., Latham. Summer.

Subspecies **Kneifii** (B. & S.) Warnst. "Sunken places about Closter, N. J.," Musc. App. 411; New Dorp, S. Id., near Moravian Cemetery!!

Subspecies **Sendtneri** (Sch.) Warnst. New Haven, Bry. Ct.

Subspecies **Wilsoni** (Sch.) Roth. Budds Lake, N. J., Austin, and Small, Bx!; Bronx R., Bronx Park, E. G. B., Bx!

D. fluitans (Dill.) Warnst. "Stagnant or sluggish water, common," Musc. App., 410, East Marion. L. Id., Latham. Summer.

Var. near var. *gracilis* (Boulay) Grout covers bottom of small pond near Vanderbilt Mausoleum, New Dorp, S. Id.

Subspecies **exannulatus** (Guemb.) Warnst. Astoria, L. Id. (H. S.)! labeled *Fontinalis.*

Var. **falcifolius** (Ren.) Grout forma **viridis** (Boulay) Grout pool by road, Cold Spring, L. Id.!!

D. uncinatus (Hedw.) Warnst. Wet shaded places in cool woods. "Near Closter, N. J.", Musc. App., 412; Orange, etc., Bry. Ct. Spring–summer. This is so common elsewhere that it should be found more frequently than is here indicated.

D. vernicosus (Lindb.) Warnst. "In open bogs and marshes about Budds Lake, N. J.," Musc. App. 402.

CALLIERGON (Sull.) Kindb.

Large mosses usually found in swamps and wet places; usually erect when growing in water. Central strand present in the stem. Stem leaves large, not falcate or secund, broadly oblong-ovate to nearly circular, usually very obtuse and cucullate at apex, very concave, little or not at all plicate, with a single strong costa reaching nearly the entire length of the leaf, or ecostate; leaf cells narrowly linear; capsules unsymmetric, inclined to horizontal, with perfect hypnaceous peristomes.

The old genus *Hypnum* included nearly the whole family as here treated and it is very difficult to break it up into separate genera satisfactorily. Though usually treated as a subgenus, *Calliergon* seems to me far better characterized than several other genera of the family that are generally recognized. The first two species placed by Sullivant in Calliergon were *Hypnum cuspidatum* and *H. Schreberi* which much resemble the other species here included, but have their leaves ecostate or nearly so.

Key

1—Leaves with a single long strong costa 3
Leaves ecostate or with costa short and double 2
2—Stems green when fully grown; ends of stems and branches cuspidate with the convolute apical leaves; plants of wet places ..... *cuspidatum*
Stems red; plants of dryer situations. Very common ..... *Schreberi*
3—Branches few; enlarged and decurrent angular cells gradually grading into the others ..... *cordifolium*
Pinnately and rather regularly branched; enlarged and swollen cells of auricles abruptly differentiated from the others ..... *giganteum*

C. cordifolium (Hedw.) Kindb. Common in wet swampy places. Spring-summer.

C. cuspidatum (L.) Kindb. "Bogs, common," Musc. App. 444; Richmond Hill, L. Id.; Closter and Clifton, N. J.; Yonkers.

C. giganteum (Schimp.) Kindb. Danbury, Ct., Nichols, Bx! Summer.

C. Schreberi (Willd.) Grout. On ground in woods, common, except on L. Id. and S. Id. Reported from Bath and New Lots, L. Id. and Giffords, S. Id. Summer.

Subfamily Hypneae

Central strand lacking or thin and few-celled; leaves often strongly falcate-secund, without costa or with costa short and double (except *Hygrohypnum* sp.); leaf cells linear-flexuose in most species (rhomboidal to linear-rhomboidal in *Amblystegiella*); capsules oblong to cylindric, typically inclined to horizontal, and unsymmetric to strongly curved, but nearly erect and symmetric in some few species; peristome perfect except in some of the species with erect capsules. This subfamily differs from the last in the slightly developed costa and longer leaf cells. *Hygrohypnum* is a connecting link.

Key to the Genera

1—Branching often regularly pinnate to plumose; leaves strongly falcate-secund; costa short and double or lacking; alar cells usually strongly differentiated ..... *Hypnum*
Branching irregular; leaves apparently in two rows, complanate, costa as in *Hypnum* ..... *Plagiothecium* and *Hypnum pratense*
Leaves neither complanate nor strongly secund, or if strongly secund, with a strongly marked costa 2

2—Leaf cells short, 2–5: 1 ..... *Amblystegiella*
Leaf cells usually narrowly linear-flexuose 3
3—Costa usually pronounced; aquatic ..... *Hygrohypnum*
Costa faint or lacking 4
4—Epidermal cells of capsule strongly collenchymatous; operculum beaked ..... *Raphidostegium*
Epidermal cells of capsule not collenchymatous 5
5—Alar cells little differentiated ..... *Plagiothecium* species
Alar cells strongly differentiated, inflated 6
6—Leaves spreading to squarrose as in *Campylium;* capsules striate. *Plagiothecium striatellum*
Leaves imbricated; capsules not striate, long-cylindric. *Hypnum Haldanianum*

HYGROHYPNUM Lindb.

Aquatic or subaquatic mosses growing on stones in and near the beds of brooks, especially in mountainous regions, often forming extensive mats, more or less filled in below with sand and gravel. Stems mostly creeping or prostrate, with ascending branches; central strand present, usually few-celled. Leaves in most species usually concave, more or less falcate-secund, comparatively *short and broad*, *soft in texture* and *often obtuse at apex*, rarely acutely acuminate, sometimes apiculate, mostly entire or slightly denticulate at apex; costa double, of varying length, or single and forking, sometimes reaching above the middle; *alar cells plainly differentiated*, *hyaline*, colored, or subopaque in the various species, often remaining on the stem when leaves are stripped off for examination. Capsules inclined and unsymmetric, rather short and thick; peristome perfect.

Nearest to *Drepanocladus*, from which it is distinguished by its habitat in running streams and its broader concave more obtuse leaves. *Scorpidium* is distinguished from this genus by its gigantic size and rugose leaves; *Calliergon* by its habitat and general appearance. Aquatic *Raphidostegia* are very close to some species of *Hygrohypnum*, and Limpricht and Brotherus put *Hypnum Novae-Caesareae* Austin in this genus, but in general the alar cells of *Raphidostegium* are more strongly developed, the costa is shorter or wanting, and the operculum rostrate. Certain *Brachythecieae*, such as *B. plumosum* or *Eurhynchium rusciforme* have a similar habitat and appearance, but are easily

distinguished by the acute leaves, strong single costa and rough seta.

KEY

1—Alar cells large and conspicuous, clear, hyaline or colored, forming distinct decurrent auricles; outer layer of stem cells much enlarged 2
Alar cells thick-walled, less distinctly inflated, granulose to subopaque, often colored; outer layer of stem cells not enlarged 3
2—Alar cells hyaline and thin-walled; costa usually reaching the middle of leaf; dioicous ..... *ochraceum*
Alar cells usually colored and thick-walled, except the outer row or two, which are usually thin-walled and often hyaline; costa double, short and faint; monoicous ..... *eugyrium*
3—Costa single, often forking and often reaching above middle 4
Costa short and double; leaves denticulate at apex ..... *dilatatum*
4—Plants minute; stem leaves flat, obtuse to suborbicular 5
Plants larger; leaves concave, oval-oblong ..... *palustre*
5—Leaves flat, entire ..... *closteri*
Leaves concave, obsoletely denticulate ..... *Smithii*

H. closteri (Aust.) Grout. "On rocks in streams about Closter, N. J.," Musc. App. 439.

H. dilatatum (Wils.) Loeske. "On rocks along streams, northern N. J., rare," Musc. App. 436 (as *Hypnum molle*); Darien, Bry. Ct. Summer.

H. eugyrium (B. & S.) Loeske. Hamden, Beacon Falls, etc., Bry. Ct. Spring.

Var. **Mackayi** (Sch.) Broth. New Haven, Bry. Ct.

H. ochraceum (Turn.) Loeske. "On rocks along streams, northern N. J.," Musc. App. 437; Yonkers, Howe, Bx! Spring–summer.

H. palustre (Huds.) Loeske. "On rocks in mountain rivulets, northern N. J., rare," Musc. App. 435.

H. Smithii (Sw.) Broth. (*Hyp. arcticum* Sommerf.) "On rocks along rivulets near Closter, N. J.," L. & J. Manual: 400. This is probably an error in determination. The N. J. plants are probably *H. closteri*. I have not been able to find out conclusively.

Scorpidium scorpioides (L.) Limpr. Margins of pond, Marksboro, N. J. Wiegmann.

HYPNUM L. (Plate XII.)

Plants usually more or less regularly pinnately branched, often plumose in appearance. Leaves *falcate-secund* and in most species apparently arranged in two rows, giving the stems a *somewhat flattened appearance on one side* (usually the upper) *and a bristly appearance on the opposite side.* Leaves in most cases long acuminate; costa short and double, or lacking entirely; leaf cells linear-flexuose, 4–20: 1, shorter at base; alar cells more or less plainly differentiated, often enlarged, hyaline or colored. Paraphyllia present in all our species, few or found only in axils of branches in some cases. Central strand in stem usually present, but few-celled. Capsules subcylindric, more or less curved and cernuous; peristome perfect (excl. *H. tenuirostris*).

Most of the mosses of this genus have a very similar appearance, due to the leaf arrangement described above and the regularly pinnate and two-ranked branching. Exceptions are *Haldanianum* with its irregular branching; leaves equally spreading, not falcate. *H. patientiae*, *H. pratense* and forms of *H. cupressiforme* are irregularly pinnate. The species grow on all sorts of habitats but many have a marked preference for decaying wood. *H. imponens* is one of our most common and typical species. Its capsule, however, is more nearly straight and erect than in most species.

Key

1—Alar cells inflated, pellucid, hyaline or colored. (Forms of *cupressiforme* may be sought here) 2
Alar cells scarcely inflated, often small and quadrate (*fertile* and *curvifolium* may be sought here) 11
2—Leaves not falcate or secund 3
Leaves secund, usually strongly falcate-secund 4
3—Leaves ovate, short-acuminate; inflated alar cells numerous, forming distinct auricles ..... *Haldanianum*
Leaves ovate-lanceolate, long and slenderly acuminate, not auricled; differentiated alar cells few, not much enlarged ..... *pratense*
4—Leaves entire or serrulate above only 5
Leaves strongly serrate above; inflated alar cells very conspicuous 9
5—Inflated alar cells numerous and conspicuous; capsules plicate when dry ..... *patientiae*
Inflated alar cells rather few 6
6—Not regularly pinnate; habit of *Plagiothecium* ..... *pratense*
Regularly pinnate 7

7—Stems reddish; capsules cylindric, little curved and suberect...*imponens*
Stems not noticeably reddish; capsules curved and inclined..... 8
8—Plants small, yellowish; capsules not plicate.....*fertile*
Plants larger, dark green; capsules plicate when dry.....*curvifolium*
9—Leaves in two rows, appearing more or less complanate; capsules curved and inclined; cilia of peristome one or two..... 10
Leaves not appearing complanate; capsules erect and symmetric or nearly so; cilia none or rudimentary.....*tenuirostris*
10—Plants larger, bright glossy yellow-green; urn of capsule twice the length of operculum.....*recurvans*
Plants smaller, usually darker green, growing at high altitudes; urn about the length of operculum.....*laxepatulum*
11—Plants very large and beautifully plumosely branched; leaves plicate. *Crista-castrensis*
Plants smaller, less plumose; leaves not plicate.....12
12—Stems reddish; quadrate alar cells not very numerous.....*imponens*
Stems not noticeably reddish; quadrate alar cells numerous.....13
13—Leaves cordate at base.....*molluscum*
Leaves not cordate at base.....14
14—Leaves entire or serrulate above.....*cupressiforme*
Leaves serrate above, serrulate nearly or quite to base.....15
15—Capsules 2.5–3 mm. long, curved and somewhat contracted below the mouth when dry.....*reptile*
Capsules 1–1.5 mm. long, nearly symmetric and not contracted below the mouth; plants of high altitudes usually .....*pallescens*

H. crista-castrensis L. "On the ground and decaying logs in deep damp woods and swamps, Closter, N. J., rare," Musc. App. 434, Cold Spring (27453)!! Summer–autumn.

H. cupressiforme L. "On rocks and roots of trees, N. J.," Musc. App. 422, 423, 421 (Closter); "Not infrequent." Flora L. Id.; Orient, L. Id., Latham; Bard Ave., Silver Lake and New Dorp, S. Id., E. G. B., Bx! (Some of the S. Id. material looks doubtful.)

Var. **resupinatum** (Wils.) Sch. "On dry rocks, N. J.," Musc. App. 420; Orient, Latham.

H. curvifolium Hedw. Orient, L. Id., Latham; near Huguenot, S. Id., Hollick & Britton, Bx!; New Haven, etc., Bry. Ct., Musc. App. 424 is *H. patientiae*, also much of the material in the local collection at the Bronx. Spring.

H. fertile Sendt. Oxford, Bry. Ct.

H. Haldanianum Grev. Common on decaying wood in damp shaded places. Autumn–winter.

H. imponens Hedw. Common on humus and decaying wood in damp shaded places. Autumn–winter.

H. laxepatulum L. & J. "In cedar swamps, northern N. J. and N. Y.," Musc. App. 341 (as *Rhynchostegium recurvans*, var.).

H. molluscum Hedw. Common except S. Id., rarely fertile. Summer.

H. pallescens (Hedw.) B. & S. "On *Kalmia latifolia* in swamps in the mountains of N. J.," Musc. App. 414.

H. patientiae Lindb. Common in damp places, usually on soil. Spring.

H. pratense Koch. On soil in wet places. "Common in N. J.," Musc. App. 425; Jamaica, L. Id. (27509)!!; Palisades, N. J. and New Dorp, S. Id., Bx! Spring.

H. recurvans (Mx.) Schwaegr. Common. Autumn–winter.

Var. **resupinatum** (Wils.) Sch. Orient, Latham!!

H. reptile Mx. Common, often depauperate and hard to recognize. Bases of trees, stones and decaying wood. Midsummer.

H. tenuirostris (B. & S.) Broth. "Northern part of the state," Geol. Survey N. J.

RAPHIDOSTEGIUM (B. & S.) De Not

Mostly slender mosses with irregular branching; paraphyllia lacking; leaves symmetric and equally spreading or somewhat secund, narrowed to the insertion, *not decurrent*, concave, not plicate; *margins entire or nearly so* (*except in Novae-Caesareae*), strongly reflexed in most cases; costa lacking or short and double; leaf cells linear-flexuose, shorter and broader at base; *at basal angles 3–8 large inflated pellucid, hyaline or colored cells*, very conspicuous; capsules small, oblong-ovoid, more or less unsymmetric and inclined (excl. *R. adnatum*); lid beaked, peristome usually perfect. Cell walls of outer layer of capsule strongly

collenchymatous (i. e., strongly nodulose at points of intersection), in all our species except *Novae-Caesareae*. This genus differs from *Hypnum*, subgenus *Pseudo-Raphidostegium*, in the lack of paraphyllia, less falcate and scarcely secund or serrate leaves, and in the characteristic cell walls of the capsules. All southern, reaching our range as a northern limit. The leaves described in this genus are from the middle of the branches.

1—Plants growing on trees, of *Pylaisia* habit; capsules erect and symmetric or nearly so.....*adnatum*
Plants growing on rocks and stones, capsules inclined to horizontal....2
2—Leaves suborbicular, serrate.....*Novae-Caesareae*
Leaves oblong-ovate to oblong-lanceolate; entire or slightly serrulate. *Carolinianum*

R. adnatum (Mx.) B. & S. (*Hypnum microcarpum* L. & J. Manual). Bark of living trees. Summer-autumn. Jamaica!! & New Lots, Brainerd (26782)!, L. Id.

R. carolinianum (C. M.) J. & S. "On damp shaded rock in mountainous regions, Palisades (very rare)," Musc. App. 338 (as *Rhynchostegium demissum*); "On stones in damp woods about Closter, N. J. Frequent," Musc. App. 339 (as *R. microcarpum* var. *anisocarpon*); near Mausoleum pumping Station, S. Id., E. G. B., Bx!; Palisades, N. J. and Bronx Park, Wiegmann.

Var. **admixtum** (Sulliv.) Grout. Bronx Park, E. G. B.

R. novae-caesareae (Aust.) R. & C. "On rocks in a small rivulet which crosses the 'State Line' between Shawangunk Mountains near High Point, sterile," Musc. App. 440.

PLAGIOTHECIUM B. & S.

Mostly loosely tufted glossy mosses, growing on moist stones and earth, roots of trees and decaying wood; irregularly branching; stems and branches appearing flattened by reason of the complanate leaves (except in *Roeseanum*, *pulchellum* and *striatellum*). The twisting to the sides makes some of the leaves unsymmetrical, (except in the species named above) but otherwise they are symmetrical. Stems and branches often ending in flagella or stolons; paraphyllia lacking. Stem and branch

leaves usually much alike, ovate to ovate-lanceolate or oblong-lanceolate, little concave, margins usually plane; differentiated alar cells few (except in *striatellum* and *latebricolor*); median cells long, linear-flexuose to linear-rhomboidal; costa lacking, or short and double, or forking. Capsules oblong-ovoid to cylindric, usually inclined and more or less unsymmetric (except *latebricolor* and *laetum*).

P. striatellum, because of squarrose leaves and inflated alar cells, is likely to be sought under *Campylium*. *Hypnum pratense* forms are apt to be sought under *Plagiothecium* because of the complanate leaves. The two subgenera are, by many authors, treated as separate genera, and there are good reasons for so doing, but in a work of this kind conservatism is believed to be most helpful.

Key

Mostly very slender plants, light yellowish green to whitish, glossy; leaves little or not at all decurrent; median leaf cells narrowly linear, alar little or not at all differentiated; capsules not plicate (except in *turfaceum*) ..... *Isopterygium*

Usually larger, darker green; leaves decurrent; leaf cells wider; alar clearly differentiated; capsules often plicate ..... *Euplagiothecium*

Isopterygium Mitt.

1—Leaves entire, scarcely a trace of serration on any leaf; cortical cells of stem very large; plants of cold ravines, growing mostly in moist crevices of ledges ..... *Muellerianum*

Leaves (some or all) more or less serrate 2

2—Leaves strongly serrate in the upper half 3

Leaves serrulate at or near apex only 6

3—Plants very slender, usually growing on decayed wood or humus, sometimes on soil 5

Plants largest of the subgenus, resembling *Euplagiothecium*, growing on earth and stones 4

4—Plants dark green; leaves distant, apex usually bluntish as in *Eurhynchium hians* ..... *geophilum*

Plants lighter green, usually yellowish and glossy; leaves closer, not blunt ..... *deplanatum*

5—Leaves short-acuminate; capsule not striate; operculum rostrate .. *Groutii*

Leaves long and slenderly acuminate; capsules somewhat striate when dry and empty; operculum conic ..... *turfaceum*

6—Plants light yellowish-green; costa very faint or none; growing chiefly in the lowlands from Long Island southwards ..... *micans*

Plants not yellowish, often dark green; costa evident, often reaching the middle of the leaf; growing in cool ravines and on mountains. *elegans*

EUPLAGIOTHECIUM

1—Leaves not complanate, squarrose-spreading; capsule strongly striate ..... *striatellum*
Leaves complanate (excl. *Roeseanum*) 2
2—Plants very slender with habit and appearance of *Isopterygium;* capsules erect and symmetric; peristomes without cilia ..... *latebricolor*
Plants more robust with the habit of *P. denticulatum* 3
3—Not complanate or only slightly so ..... *Roeseanum*
Conspicuously complanate 4
4—Plants dingy or yellowish-green; leaves shrunken when dry; dioicous; operculum rostrate ..... *sylvaticum*
Plants bright green; monoicous; operculum conic 5
5—Edges of leaves strongly incurved and clasping the base of the leaf above, *Fissidens*-fashion. Plants of swamps ..... *Ruthei*
Leaves not as above or to only a slight degree; plants of varied habitat *denticulatum*

P. deplanatum (Sch.) Grout. Closter, N. J., Austin, Bx!; "Palisades, N. J.," Musc. App. 344. [Dr. Best has called this *P. silesiacum* (Selig.) B. & S.]. Rarely fertile.

P. denticulatum (L.) B. & S. Very common on moist soil, stones, etc., in woods. Summer. Forma *propagulifera* Ruthe, swamp, Valley Stream, L. Id.

P. elegans (Hook.) Sull. "Crevices of shaded rocks, northern N. J.," Musc. App. 348, also 350 from Suffern, N. Y., as var. *gracilens.*

P. geophilum (Aust.) Grout. "On clayey shaded ground, N. J.," Musc. App. 345; Richmond, S. Id.!! Spring.

P. Groutii Card. & Ther. Type from hollow in base of chestnut tree, Hempstead, L. Id. A subspecies of *P. micans.*

P. latebricolor (Wils.) B. & S. "About the roots of old stumps, etc., in swamps near Closter, N. J.," Musc. App. 353. Flushing, L. Id.!! Rare; autumn.

P. micans (Sw.) Paris. Frequent on rotten wood and soil at base of trees. Lawrence, L. Id.!!; Ocean Terrace, S. Id.; Closter, N. J.; Pelham Parkway, the Bronx. January.

P. Muellerianum Sch. "Rocky ravines, N. Y. & N. J.," Musc. App. 351; Pascack and Closter, N. J., Austin, Bx!; Hamden, Bry. Ct. This rare species usually grows in damp crevices of shaded ledges.

P. Roeseanum (Hampe) B. & S. A subspecies of *P. denticulatum*, frequent on damp peaty soil and shaded rocks and banks, Closter, N. J.; Gowanus and Glen Cove, L. Id.; Bulls Head and Tottenville, S. Id.!!

P. Ruthei Limpr. Common on peaty soil along the south shore of L. Id. (N. Am. Musci Pl. 55); Bulls Head, S. Id., and probably frequent along the coast. A subspecies of *P. denticulatum.*

P. striatellum (Brid.) Lindb. Very common on hummocks in swamps. Summer.

P. sylvaticum (Huds.) B. & S. Frequent in damp woods. There are innumerable intergradations between this and *P. denticulatum.*

P. turfaceum Lindb. "On the ground in woods and on decayed wood in cedar swamps, Palisades, N. J.," Musc. App. 356; decayed trunk of pollarded willow, Richmond, S. Id.!!, and also stumps at New Dorp, E. G. B., Bx!

(*P. passaicense* Aust., Musc. App. 353, from Bergen Co., N. J., is probably a form of *P. latebricolor. P. subfalcatum*, Musc. App. 366 is regarded by Kindberg as a form of *P. denticulatum.*)

AMBLYSTEGIELLA Loeske

Usually treated as a section of *Amblystegium*, but differing from the true *Amblystegia* in the smaller size, lack of central strand and in the slightly developed costa, which is either wanting or very faint. Nearly all our species, except *adnata*, have a tendency to become stoloniferous and the leaves on the stolons are much smaller than the normal leaves. Therefore, well-developed leaves should be sought for study.

1—Plants of the size and habit of *Hypnum reptile;* leaves reaching more than 1 mm. in length ..... *adnata*
Plants minute; leaves not over 0.6 mm. in length 2

2—Leaves narrowly triangular-lanceolate, not narrowed to insertion; alar cells at margin all longer than broad; median 5–10: 1. *minutissima*

Leaves narrowed to insertion; median cells shorter, alar quadrate. *confervoides*

A. adnata (Hedw.) Nichols. On stones and base of tree in shaded places, frequent. Summer.

A. confervoides (Brid.) Loeske. "On limestone rocks, N. J.," Musc. App. 368, Sussex Co. and Hohokus, N. J., Aust., authenticated by L. S. Cheney, Bx!

A. minutissima (Sull. & Lesq.) Nichols. "In old wells, northern part of the state," Geol. Survey N. J.

Subfamily Entodonteae

Plants of large or medium size, none minute, typically hypnaceous; leaves not papillose, often concave or plicate or both; costa lacking or short and double; median leaf cells linear; alar quadrate (in our forms): seta smooth; *capsule erect, straight, not conspicuously contracted under the mouth* when dry; *peristome with cilia rudimentary or wanting*, segments often narrow and basal membrane sometimes nearly lacking.

This group has contained a heterogeneous collection of mosses of various relationships, their association being based upon the erect capsule and incomplete peristome. I have shown elsewhere that a degeneration of the inner peristome is associated with erect capsules even though it may not (as I think it is) be a result as well. There is no more reason why *Homalothecium* or *Climacium* should be placed in this subfamily than there is for doing the same with *Brachythecium acuminatum* or even *Plagiothecium latebricolor*.

Key to Genera

1—Plants robust, glossy yellow-green; leaves symmetric but very concave. . . . . *Entodon*

Plants slender, dark green, rarely glossy. 2

2—Leaves somewhat falcate, ends of branches curved when dry. . . *Pylaisia*

Leaves not falcate, branches not curved. . . . . *Platygyrium*

ENTODON C. M. (*Cylindrothecium* B. & S.)

Growing in wide intricate *glossy* yellow-green mats; stems densely leafy, *turgid with the very concave leaves* or in most species

somewhat flattened. Leaves nearly entire or very slightly serrate at apex, very concave, not *striate or plicate when dry,* ecostate or with costa very short and double; leaf cells linear, *enlarged and quadrate at the basal angles:* capsules cylindric, erect and symmetric; operculum conic to conic-rostrate, annulus usually large and conspicuous, remaining attached longer than is usually the case; peristome with *cilia rudimentary or wanting and segments narrow,* basal membrane usually very narrow.

Their brilliant color and flattened habit (julaceous in *E. seductrix*) render this genus easy of recognition. The leaves are so much nearer together than in most other flattened forms that one is not likely to put them with forms like *Plagiothecium.* In fruit *Brachythecium acuminatum* is our only moss likely to be misplaced in this genus.

KEY

1—Leaves gradually narrowly acuminate; segments of endostome adhering to the teeth ..... *brevisetus*
Leaves merely acute or apiculate, segments free 2
2—Leafy stems and branches rounded (terete) ..... *seductrix*
Leafy stems flattened 3
Plants robust; capsules 3–5mm long, 5–6:1, peristome teeth not papillose above ..... *cladorrhizans*
Plants more slender; capsules 2.5mm long, 4:1, teeth papillose ..... *compressus*

E. brevisetus (Hook & Wils.) J. & S. "On leaning trunks of trees, old logs and stone fences; also on rocks associated with *Dicranum scoparium* var. *rupestre,* Palisades and northern N. J.," Musc. App. 285.

E. cladorrhizans (Hedw.) C. M. Cold Spring (25906)!! and Northport, Sanial on L. Id.; "Palisades and northern N. J.," Musc. App. 284. Autumn. Much of the local material at the Bronx is *E. seductrix.*

E. compressus (Hedw.) C. M. "On decayed stumps of trees, Weehawk, N. J.," labeled in Torrey's handwriting in the Torrey Herbarium at the Bronx.

E. seductrix (Hedw.) C. M. Common. A specimen from Barnes' Woods, S. Id., E. G. B., Bx! resembles *E. compressus* in appearance and should probably be referred to var. *Demetrii*

(R. & C.) Grout, although some of the branch leaves are serrulate. Autumn–winter.

PLATYGYRIUM B. & S.

The microscopic structure of this genus is so like that of *Entodon* that I placed it in that genus in my monograph (Bull. Torr. Bot. Club **23:** 227), but the dark-green scarcely glossy appearance and the small terete branches much more closely resemble *Pylaisia* than *Entodon*.

From *Pylaisia* this species is distinguishable by the fact that the leaves are not at all falcate-secund and the branches are little if any curved at the ends. The ends of the branches often bear gemmae in the axils of the leaves.

P. repens (Brid.) B. & S. On bark of trees, on logs and stumps. Frequent. Smithtown and Jamaica, L. Id.; Willow Brook!! and Todt Hill, S. Id.; Bronx Park, Pelham Parkway, Yonkers; Closter. Autumn.

PYLAISIA B. & S. (Not Desv.)

A genus of tree-growing mosses sometimes found on fallen trunks, usually easy of recognition by reason of their slender branches, curved when dry and almost hooked at the ends by reason of the falcate-secund leaves and also by their small erect and cylindric capsules, having very degenerate inner peristomes; cilia lacking (or very rudimentary in *polyantha*) and often having the segments adherent to the teeth. The leaves are ecostate or with costa short and double, concave, entire or slightly serrulate above. The annulus is much narrower than in *Platygyrium* or *Entodon* (except *E. seductrix*).

Key

1—Segments of endostome free from the teeth. . . . . *subdenticulata*
Segments of endostome wholly or partially adherent to the teeth. . . . 2
2—Segments partially adherent; spores 18–24μ. . . . . *Schimperi*
Segments wholly adherent, 25–70μ. . . . . *intricata*

P. intricata (Hedw.) R. & C. (*P. velutina* Schimp.) Van Cortland Park, E. G. B., Bx!; "On trees in swamps and in mountainous regions, N. J.," Musc. App. 293; Yonkers, E. C. Howe.

P. Schimperi R. & C. (*P. intricata* B. & S.). Frequent on apple and shade trees beyond city conditions. Autumn.

P. subdenticulata Schimp. "On bases of white oaks about Closter, N. J.," Musc. App. 290. "Richmond Hill," Flora L. Id.

Family 23. FABRONIACEAE

Smallest and most delicate of the Pleurocarpi except *Amblystegiella*. Mostly plants of warmer regions, growing in rather thin tufts, often glossy. Stems without central strand, creeping, producing many erect and simple or somewhat divided branches; paraphyllia lacking; branches densely leafy; leaves *soft*, rarely or not at all complanate or secund, *closely imbricate when dry, not decurrent or plicate*, ovate to ovate-lanceolate, acuminate, entire in some species, ciliate-dentate in others; costa lacking or single and extending ½ length of leaf; leaf cells thin-walled (except *Habrodon*), median linear-rhombic to hexagonal; basal and alar often quadrate to short rectangular; none papillose; capsule erect and symmetric, cylindric to ovoid, often strongly contracted under the mouth when dry and empty; peristome single or double, the outer 16 teeth often united in pairs and reflexed as in *Orthotrichum;* segments of inner peristome, when present, narrowly linear. Rare in our range, usually on trees.

Key to the Genera

1—Leaves ciliate-dentate ..... *Fabronia*
Leaves entire 2
2—3 or 4 rows of quadrate to rectangular basal cells; peristome reflexed when dry ..... *Anacamptodon*
Roundish-quadrate cells extending well up leafmargins .... *Clasmatodon*

ANACAMPTODON Brid.

A. splachnoides (Froelich) Brid. Our only species, dark green; leaves ovate-lanceolate, acuminate, entire; leaf cells rhombic-hexagonal, quadrate to rectangular at base: seta 5–8 mm. long, annulus lacking; *peristome double; teeth approaching each other in pairs and reflexed when dry; segments filiform with no basal membrane;* spores papillose, maturing in June. *Moist*

cavities in decaying wood especially knotholes in living trees. Cheshire, Hamden, and New Haven, Bry. Ct. Should be found nearer.

Clasmatodon parvulus (Hampe) Sull. and *Fabronia octoblepharis* (Schleich.) Schwaegr. are found at the Delaware Water Gap.

Family 24. LEUCODONTACEAE

Tree-growing mosses, rarely found on rocks, often julaceous and glossy; main stems slender, creeping, irregularly branching; secondary stems numerous, horizontal to drooping and outwardly curved, paraphyllia lacking in most species; leaves of secondary stems ovate to ovate-lanceolate, concave, costate or ecostate, entire or nearly so, closely imbricate when dry, spreading when moist, not papillose; leaf cells short, roundish-oval to fusiform in the middle portion of the leaf; perichaetial leaves long-sheathing, seldom much shorter than the seta and often extending beyond the capsule; capsules erect and symmetric, mostly ovoid; peristome simple.

Key to Genera

1—Secondary stems little branched; calyptra not hairy.....2
Secondary stems freely branching, often subpinnate; calyptra hairy.....*Forsstroemia*
2—Plants very slender; capsule immersed; seta almost lacking.....*Cryphea*
Plants stouter; seta much longer than capsule.....*Leucodon*

LEUCODON Schwaegr.

The various species of *Leucodon* grow almost exclusively on the bark of deciduous trees, very rarely are any found on dry rocks. The Leucodons are seemingly able to do without moisture for considerable periods, as they rarely or never grow at the base of trees, but at a height of five or six feet and above. The main stems are long, slender, branching, almost filiform, with minute leaves and abundant rhizoids. The secondary stems are numerous, suberect, horizontal, or hanging downward and curved outward, usually julaceous and nearly simple; paraphyllia lacking. Leaves many ranked, concave, with margins recurved below, ecostate, entire or slightly serrulate at apex,

closely appressed when dry, spreading when moist; leaf cells thick-walled; several rows of marginal cells roundish-quadrate; the lower median linear-fusiform, gradually changing to oval at the apex; basal cells often brownish or reddish yellow. Dioicous. Calyptra cucullate, smooth, often attached below the capsule by the connate base. Capsules exserted or emergent, erect and symmetrical; peristome apparently simple, teeth 16, articulate and papillose, bifid or occasionally trifid; inner peristome reduced to a narrow inconspicuous membrane.

L. brachypus Brid. Orient, Latham; Guilford and New Haven, Bry. Ct.

L. julaceus (Hedw.) Sull. Moriches (H. S.!), Bath, Brainerd and Cold Spring!!, L. Id. "On trees common" Musc. App. 258.

FORSSTROEMIA Lindb.

(*Leptodon* of L. & J. Manual)

Much like *Leucodon*, but distinguished in all our species by the abundant branching of the secondary stems and by the hairy calyptra. Many species have strongly costate leaves and most are less glossy than *Leucodon*.

F. trichomitria (Hedw.) Lindb. Common on trees and rocks, Musc. App. 254; Closter, Austin, Bx!

CRYPHEA Mohr.

Cryphea glomerata B. & S. "Red Cedars, Palisades, N. J., rare," Musc. App. 253.

Family 25. NECKERACEAE

Mostly growing on rocks and trees. Primary stems creeping and defoliate; secondary stems erect, horizontal, or pendent, irregularly to pinnately branching; leaves large, ovate-lanceolate to lingulate or cultriform, acute, obtuse or apiculate, ecostate or with a slender costa; leaf cells not papillose, short, rhombic to linear, quadrate to roundish on the margins. Calyptra smooth or hairy; capsule erect and symmetric, immersed or emergent, rarely with seta longer than perichaetium; peristome single or double.

Key to Genera

Leaves cultriform, costate in our species.....*Homalia*
Leaves ecostate.....*Neckera*

HOMALIA (Brid.) B. & S.

Leaves costate and capsule long-exserted.

H. Jamesii Schimp. Hamden, Bry. Ct.

NECKERA Hedw.

Plants usually large (excl. *gracilis*), growing on trunks of trees or rocks; primary stems creeping, often stoloniferous; secondary stems erect to pendent, often pinnately branched, usually complanate-foliate; stems and branches sometimes flagelliform; leaves often transversely undulate, ovate-lanceolate to oblong or lingulate, frequently unsymmetric, ecostate or nearly so; leaf cells broadly rhomboidal at apex and upper margins, changing to linear-oblong to linear-flexuose at base; capsules immersed or exserted; peristome double, the inner a short membrane with short segments or with segments longer and narrowly linear, cilia wanting; annulus lacking.

Key

1—Leaves ovate-lanceolate, undulate, acute.....*pennata*
Leaves oblong, not undulate, rounded at apex, often apiculate; plants filiform.....*gracilis*

N. pennata (L.) Hedw. Closter, N. J., Austin, Bx!; "On trees and rocks, common," Musc. App. 255.

N. gracilis (James) Kindb. (*Homalia gracilis* James). "Under overhanging rocks, Palisades, N. J.," Musc. App. 257.

FAMILY 26. FONTINALACEAE. WATER MOSSES

Aquatic, floating, usually slender, *attached at base of stems* only, often very long, dark to blackish green, especially below. Central strand lacking in the stems. Leaves ecostate in *Fontinalis*, costate in *Dichelyma*, mostly decurrent, entire or slightly denticulate at apex; leaf cells rhomboid-hexagonal to linear-flexuose, broader and shorter at base of leaf and often at apex also.

Seta short; *capsule immersed in the perichaetial leaves or shortly exserted, without neck or stomata;* annulus lacking; peristome double, the outer composed of 16 teeth, *the inner of 16 linear divisions more or less completely united by cross strands at regular intervals, forming a regular net* or trellis through the meshes of which the spores gradually escape.

Although mosses belonging to several other families are aquatic, the mosses of this family are most emphatically entitled to the name of Water Mosses, as the members of the family are either submerged all the time or attached to objects that are submerged at high water.

Key to the Genera

Costa lacking, leaves mostly symmetric ..... *Fontinalis*
Costa present, leaves mostly falcate-secund ..... *Dichelyma*

DICHELYMA Myr.

Plants growing near the edge or surface of the water, generaliy submerged at high water, shorter than *Fontinalis* with the appearance of *Drepanocladus;* leaves three-ranked, costate, narrowly lanceolate, secund to falcate-secund; leaf cells narrow, linear; basal shorter, brownish, not forming auricles. Dioicous; perichaetium very long, cylindric, the leaves convolute, very long, spirally twisted, ecostate; seta of moderate length enclosed by the perichaetial leaves, sometimes longer and sometimes shorter than the perichaetium; peristome much as in *Fontinalis*, but the teeth shorter than the inner peristome.

D. capillaceum B. & S. Frequent on sticks and stones in water. Ridgewood (25473) and Gowanus (25474), Northport, Orient, Forest Park (25475)!!, L. Id.; Red Lane and Court House, S. Id.; "Common," Musc. App. 252.

FONTINALIS Dill.

Stems usually *denuded of leaves below, long slender and floating*, freely branched, usually blackish green, except the latest growth; *leaves ecostate*, sometimes nearly flat, but usually strongly concave to nearly tubular. (The young undeveloped leaves at the ends of the shoots are always convolute.) Median leaf cells

linear, often long and narrow; alar cells subrectangular to subhexagonal, forming more or less distinct auricles. Dioicous; capsules *sessile, little exceeding the perichaetial leaves;* outer peristome teeth long, sometimes united at apex.

All our species are submerged, some grow attached to stones and sticks in swift brooks, others in ponds and sluggish streams. Rarely, if ever, are they found in stagnant water. By reason of the peculiarities named the genus is easy to recognize, but the species are often difficult or impossible to distinguish without authentic specimens for comparison, as there is relatively very little difference in the areolation of the leaves.

I have used to a very great extent the monograph of the family by M. Jules Cardot and hereby acknowledge my indebtedness to him, although I must confess that his eyesight for specific distinctions seems to be considerably more acute than mine. The difficulty of identifying sterile and poorly developed forms is emphasized by the fact that all the older American exsiccati are badly mixed.

KEY

1—Plants very large, leafy stems triangular, 5–7 mm. in diameter; leaves keeled ..... *gigantea*
Plants much smaller, not evidently three-cornered; leaves concave but not keeled 2
2—Plants very slender and rather rigid; leaves oblong-lanceolate to narrowly lanceolate 3
Plants much stouter; leaves broader, oblong-lanceolate to ovate 4
3—Stem and branch leaves markedly different; stem leaves 4–6 mm. long, very longly and slenderly acuminate ..... *Sullivantii*
Stem and branch leaves little different, 2–3 mm. long, much less slenderly acuminate ..... *dalecarlica*
4—Leaves distant, loosely erect-spreading, usually plane or slightly concave above, rather slenderly acuminate, acute or somewhat obtuse, soft ..... *Lescurii*
Leaves less spreading, closer, concave and often cucullate above, less slenderly acuminate, more broadly obtuse, more rigid ... *novae-angliae*

F. dalecarlica B. & S. "Rocky rivulets, common," Musc. App. 251, Closter, Austin, Bx!; Fairy Dell, Quogue, Mrs. J. K. Creevy (25425).

F. gigantea Sull. Frequent in brooks. Not reported from S. Id. Summer.

F. Lescurii Sull. Bulls Head, Pleasant Plains (N. Am. Musci Pl. 428, det. Cardot) and Court House, S. Id.; Yonkers, Howe; 246, 247, 248 Musc. App. labelled this species are *F. novae angliae* according to Cardot. Most of the S. Id. material at the N. Y. Bot. Gardens labeled *F. biformis* is this species or *F. Sullivantii.*

F. novae-angliae Sull. New Dorp!! and Egbertville and Tottenville, S. Id.; Common in N. J. according to Austin (See the preceding); Flushing, L. Id., Hulst, Bx!

F. Sullivantii Lindb. "Stagnant pools in woods about Closter, N. J.," Musc. App. 249, also Suppl. 524, according to Cardot; Toms R., N. J., E. G. and N. L. Britton, Bx!; Greenport, Latham; Court House, S. Id. E. G. B.!; Bronx Park, E. G. B., Bx!

F. involuta R. & C. According to Cardot part of Musc. App. 248 from Ponds of N. J. is this species. Gilman has a specimen from "Near State Line, N. Y. & N. J.," at Bx!; Manchester, N. J., *fide* Cardot.

Distinguished from *F. novae-angliae* by the narrower leaves, strongly involute on the borders, canaliculate and cucullate at the apex; generally appearing distichous. *Fide* Cardot.

F. microdonta Ren. "New Jersey," Cardot, Monographie des Fontinalacées: 121. Distinguished from *F. Sullivantii* by its less rigid appearance, softer leaves, and rudimentary inner peristome. *Fide* Cardot.

ADDENDA (Reported by Wiegmann)

Dicranum Muhlenbeckii B. & S. On bare limestone with *Carex eburnea*, Swartswood N. (49 miles from City Hall.)

Dicranum spurium Hedw. Bare trap rock. Plainfield, N. J.

Fissidens incurvus Schwaegr. Wiegmann reports spores mature in August in brooks at Alpine, N. J.

F. Julianus (Savi.) Sch. Bronx R. below falls in Bronx Park.

Encalypta streptocarpa Hedw. Crevices in dolomite ledges, 231st St. and Broadway, N. Y. City.

Bryum Duvallii Voit. Swartswood, N. J. Doubtful.

FIG. 1—*Webera sessilis* × 5

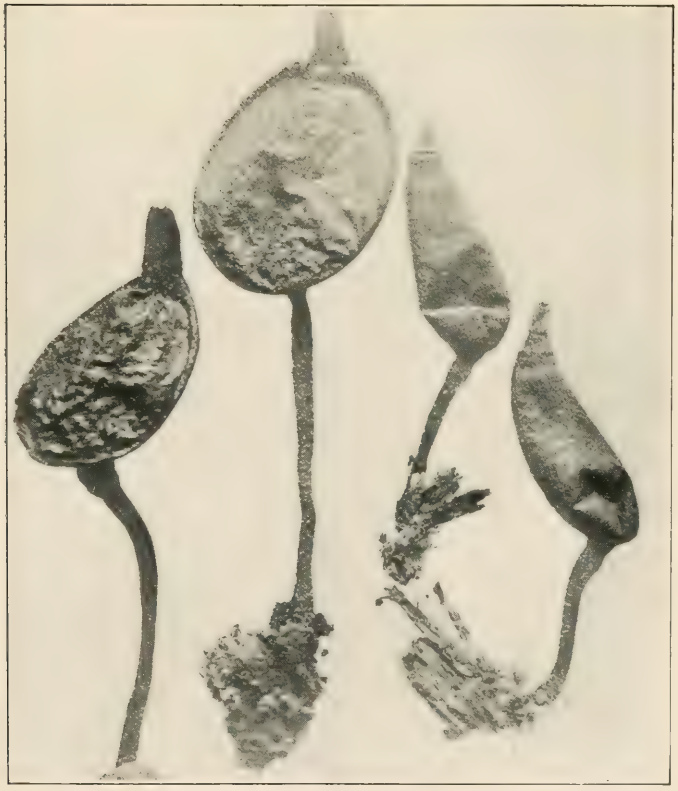


FIG. 2.—*Buxbaumia* × 9. *B. aphylla* (left) and *B. indusiata* right). From herbarium specimens

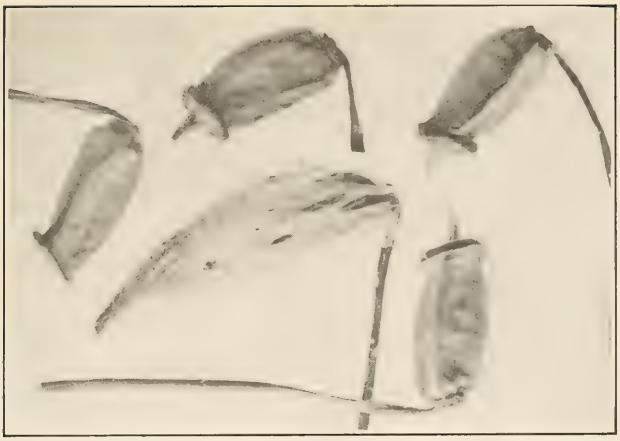


FIG. 1.—Capsules of *Polytrichum juniperinum* × 5.

FIG. 2.—*Ceratodon purpureus*, dry. × 5.

FIG. 1.—*Dicranum scoparium*, nearly × 2, showing the sporophytes for 3 successive years

FIG. 2.—*Grimmia apocarpa* × 5

Orthotrichum strangulatum × 15

FIG. 1.—Capsules of *Philonotis fontana*, *Bartramia pomiformis* and *B. Oederi* × 4

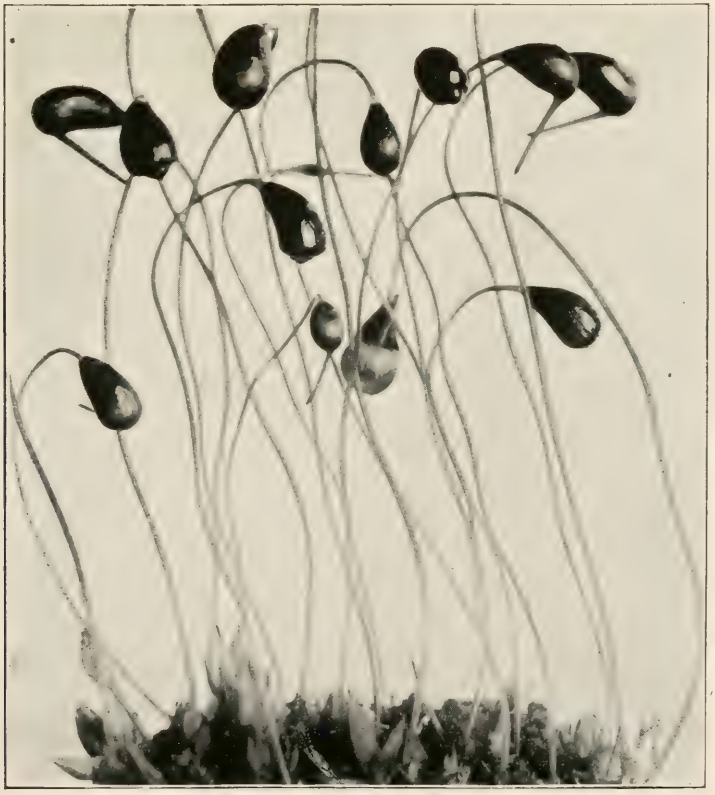


FIG. 2.—*Funaria hygrometrica* × 4

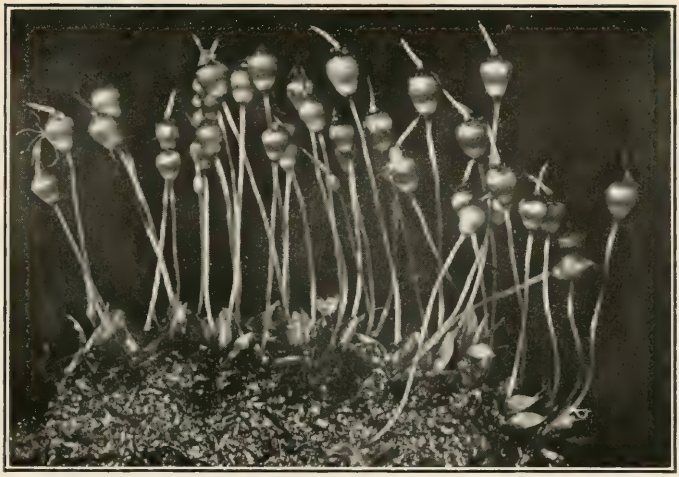


FIG. 1.—*Physcomitrium turbinatum* × 4

FIG. 2.—*Bryum caespiticium* × 2

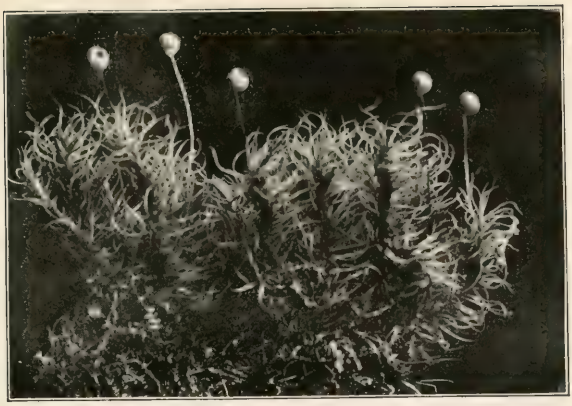
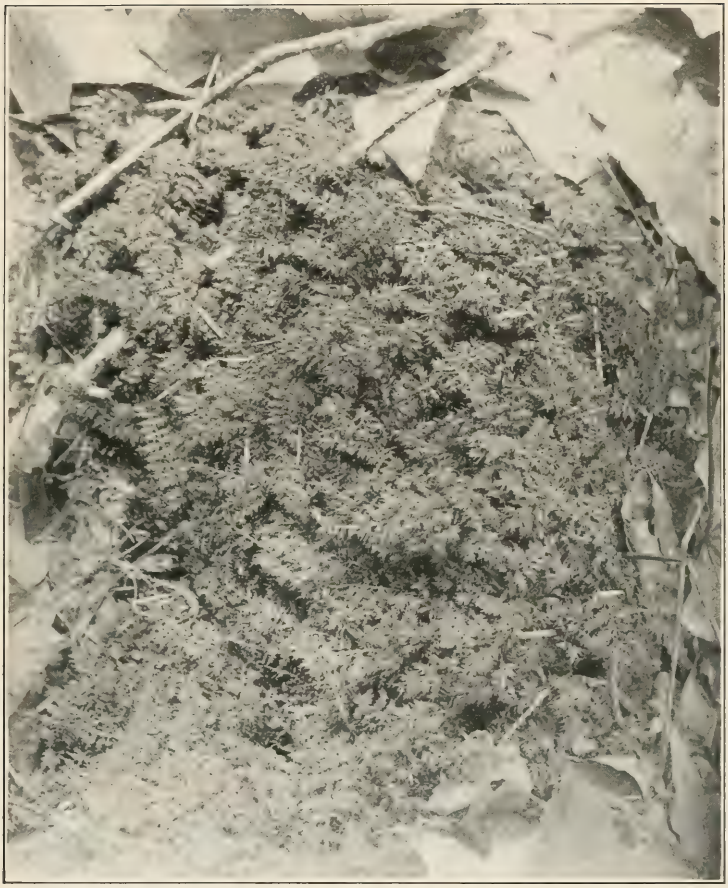


FIG. 1.—*Bartramia pomiformis* × 2

FIG. 2.—*Mnium punctatum elatum*, slightly enlarged

PLATE VIII.



Thuidium delicatulum in situ, slightly reduced

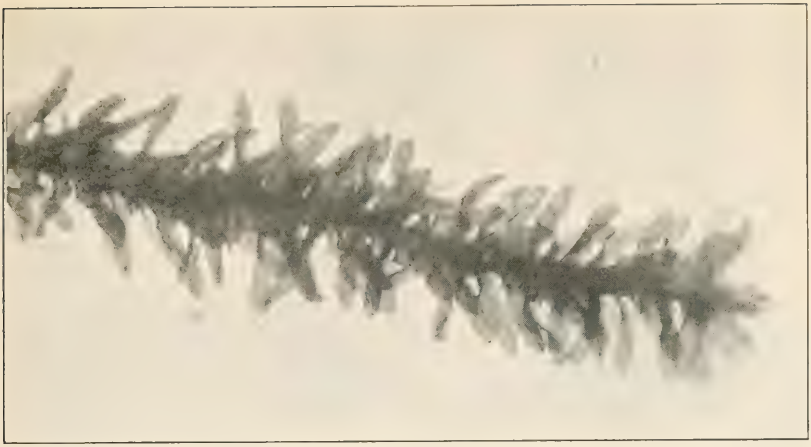


FIG. 1.—*Anomodon minor* × 8

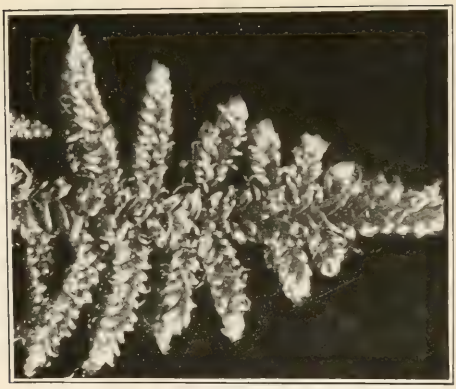
FIG. 2.—*Thelia hirtella* × 5

PLATE X.

Eurhynchium rusciforme × 5. From herbarium specimens.

PLATE XI.

Drepanocladus uncinatus × 5. From herbarium specimens.



Hypnum imponens × 2. Above is a single spray × 7

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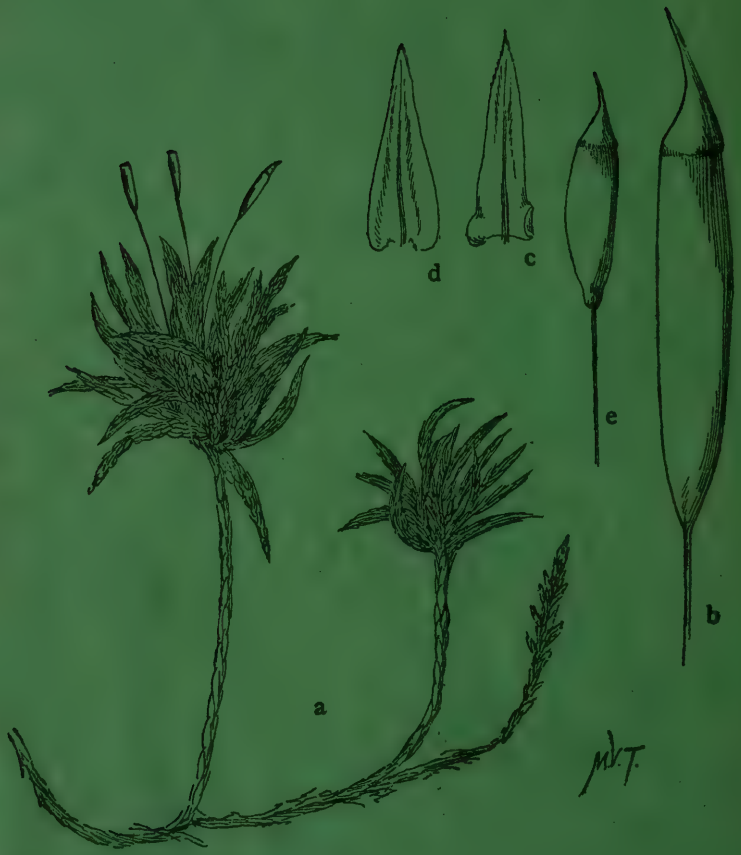
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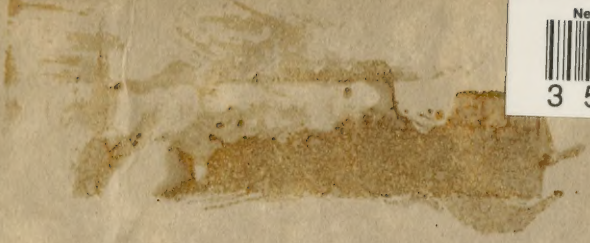

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